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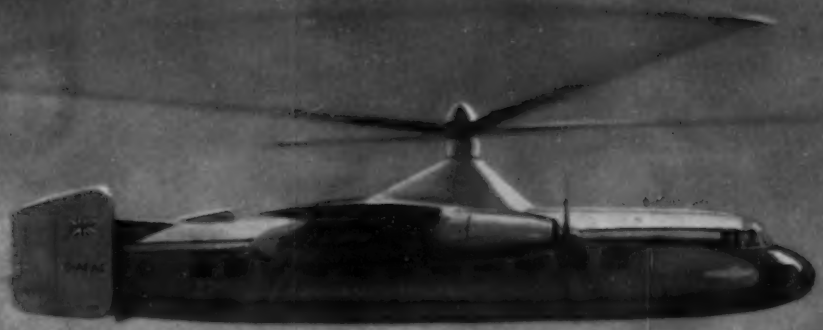

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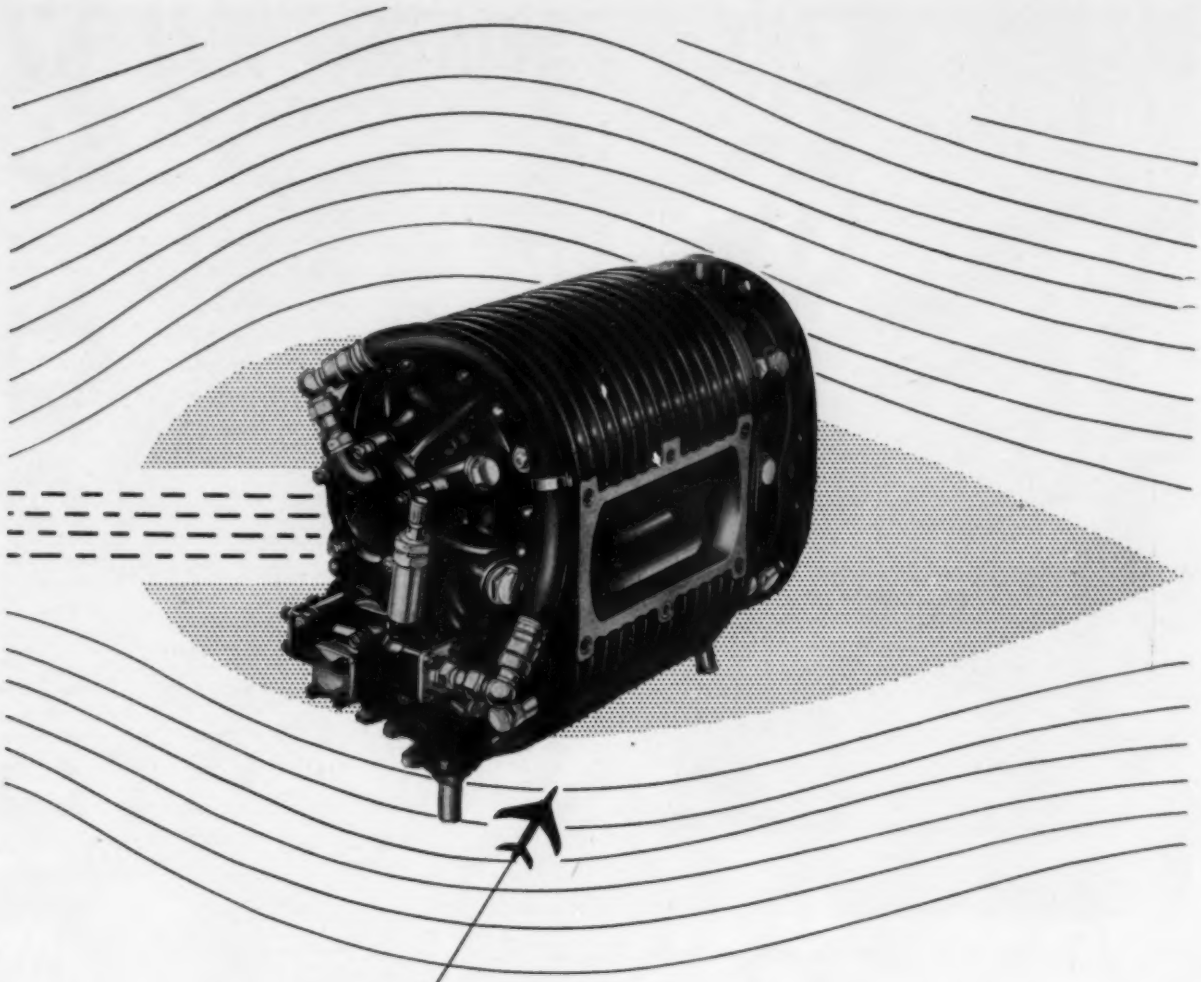

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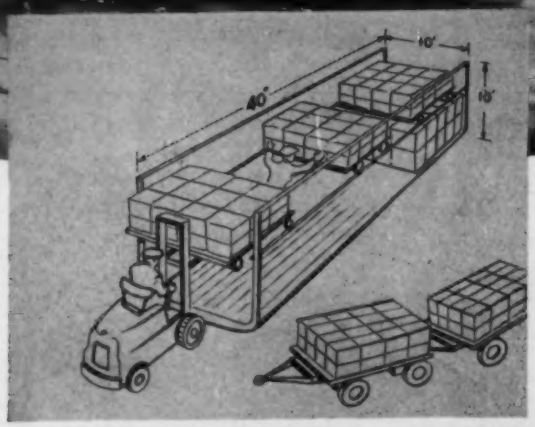

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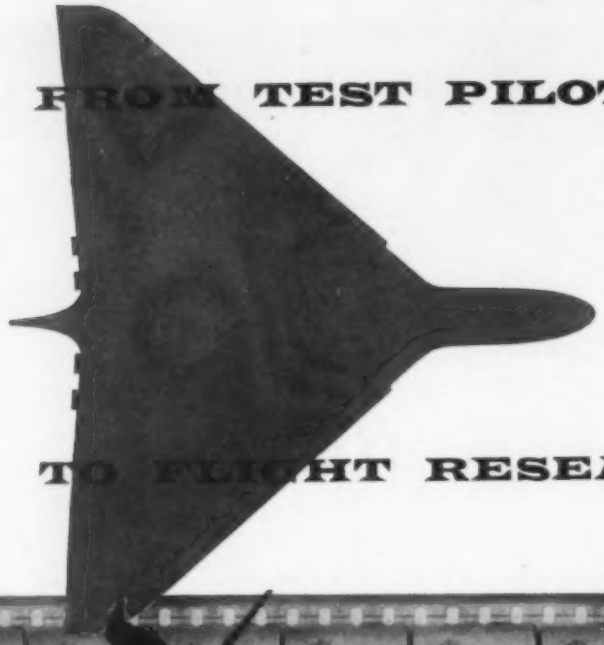
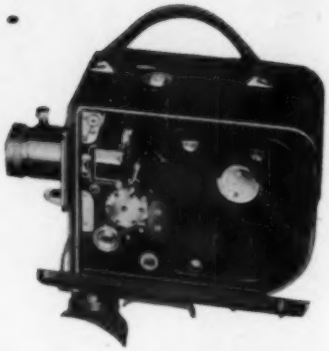


TO FLIGHT RESEARCH



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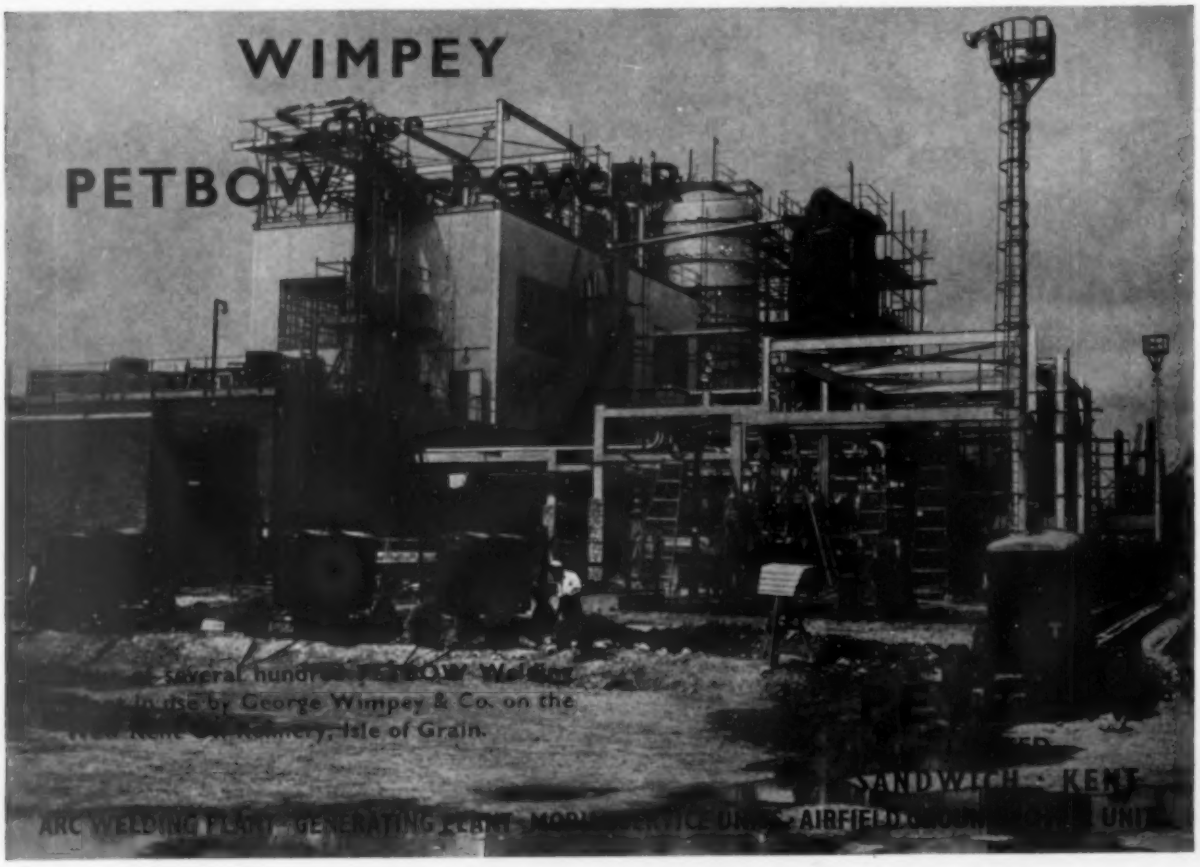

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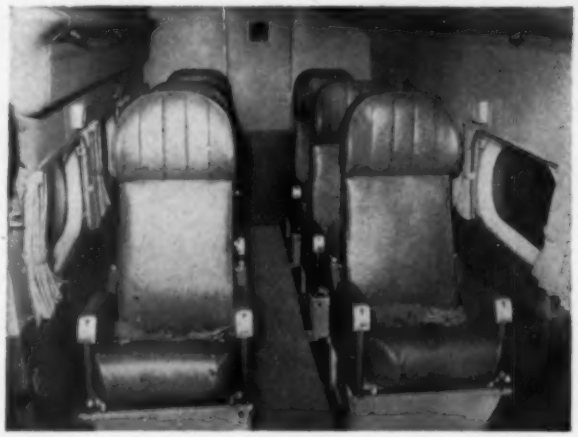

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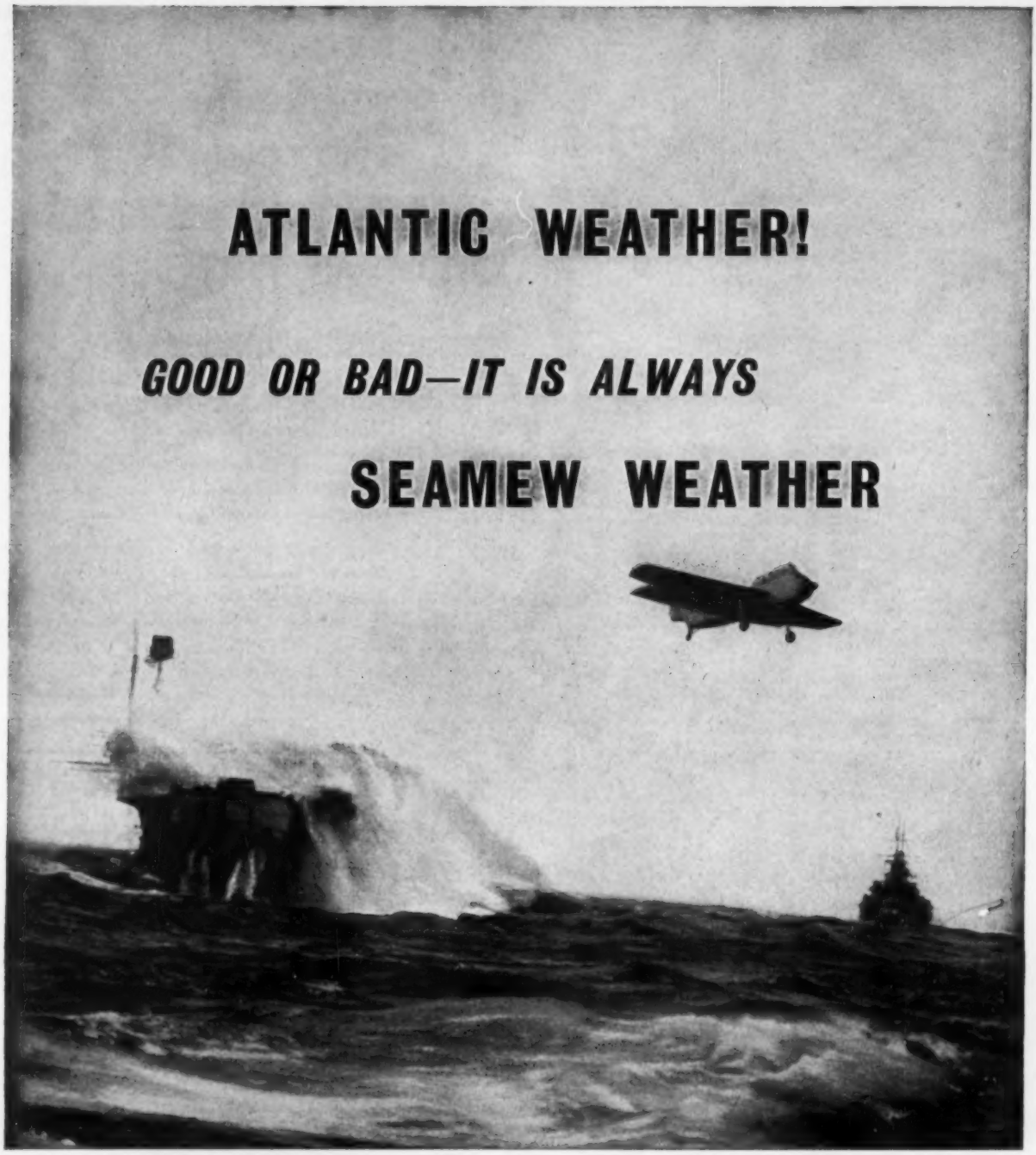

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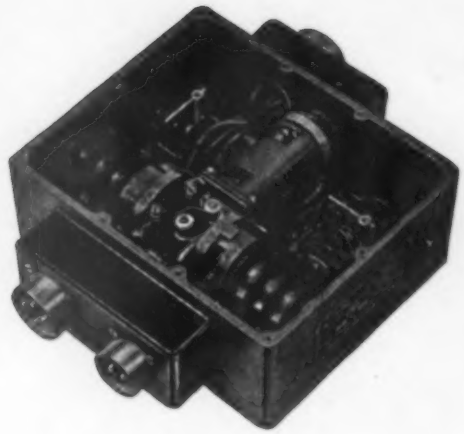

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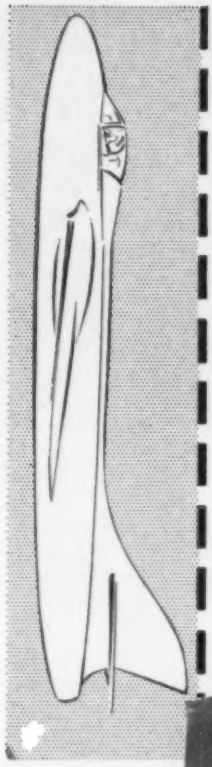

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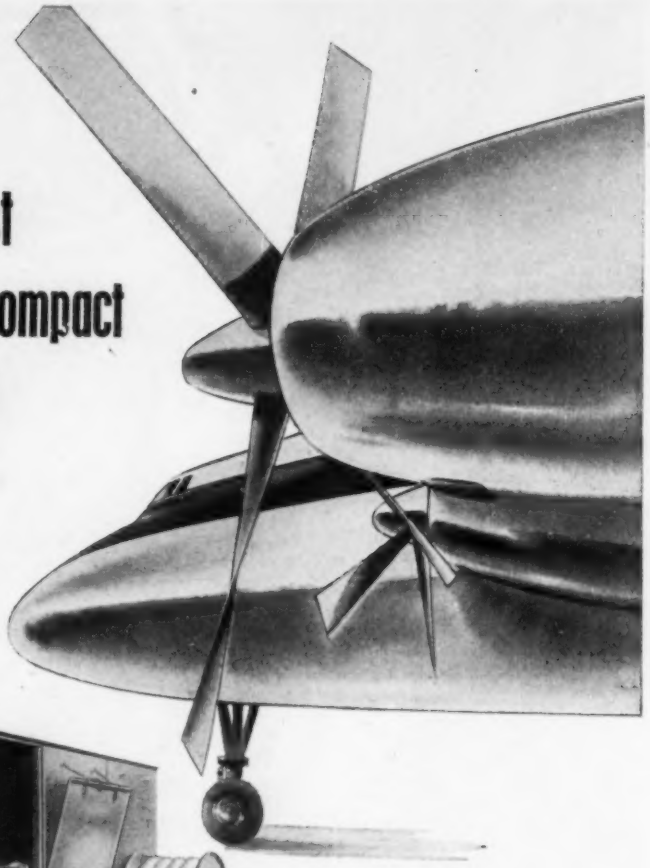

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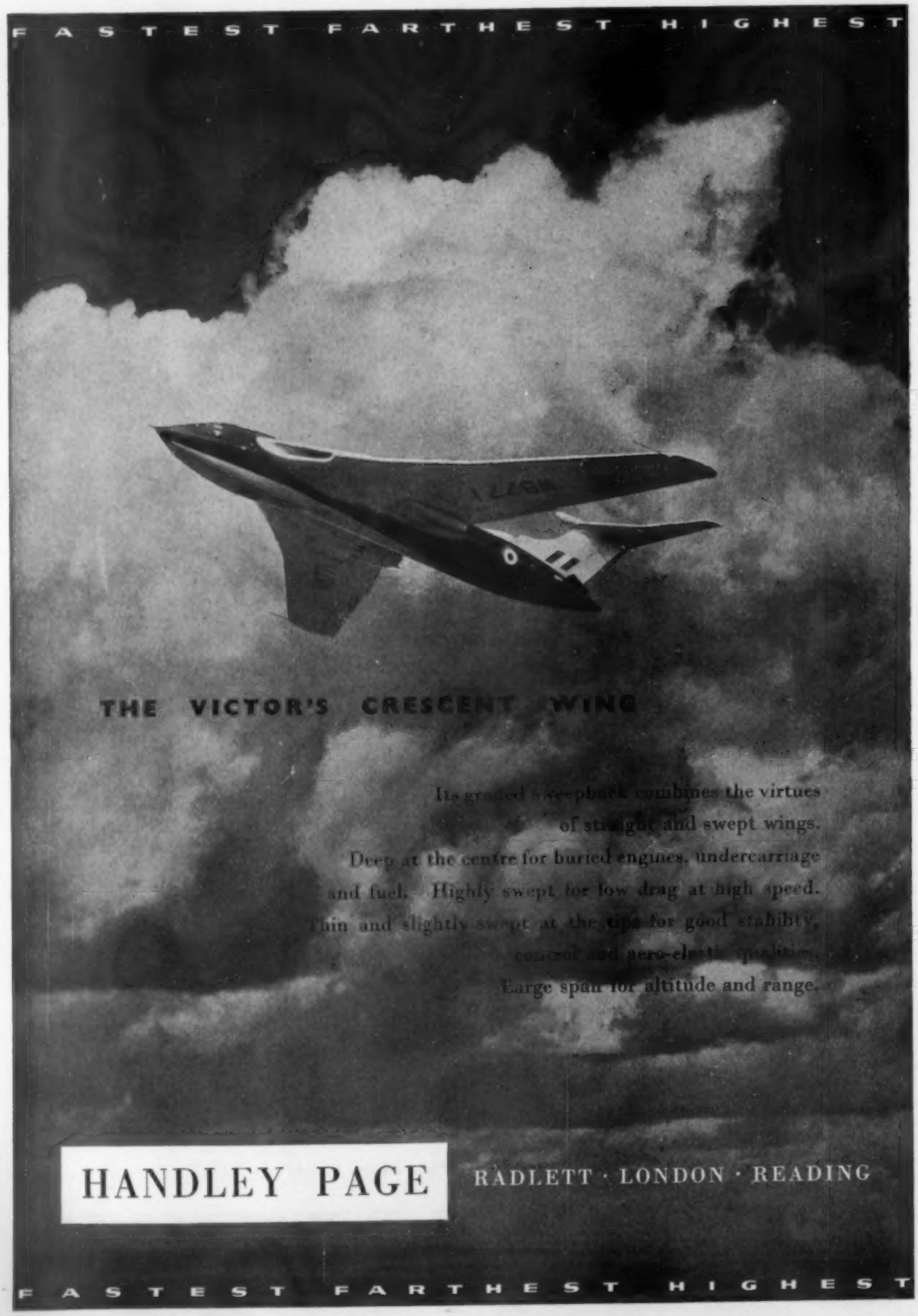
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Clearing the Air

A CONFERENCE on European air transport, inspired by the Council of Europe and organized by I.C.A.O., is now in progress at Strasbourg. Although it has so far almost escaped public attention, this meeting could produce decisions capable of dominating the future development of air transport—not only in Europe but throughout the world.

Essentially, Strasbourg represents an attempt to solve a global problem on a regional basis. This problem—the multilateral exchange of traffic rights—has defied solution since it was first discussed by representatives of all the nations of the free world at Chicago in 1944.

Fear of aggression has already brought a good measure of unity into European military aviation. But there are economic as well as military reasons for pooling of resources, and the Council of Europe has sought for some years to produce a formula for co-ordinating air transport within their province.

National pride thrives on tradition, and the smallest European countries rightly regard their own airlines as equal in all but size to the big carriers. Despite the isolated precedent set by the Scandinavians in forming S.A.S., the prospects of further large-scale merging of European airlines—however desirable they might be on theoretical grounds—still remain distant.

Some of the larger nations taking part in the Strasbourg discussions are advocating that the Fifth Freedom (the right to carry traffic between foreign countries) should be the general rule rather than the carefully negotiated exception; others oppose this principle or have perhaps entered the conference with an open mind. No fewer than 20 nations are taking part, and, though we hope otherwise, we doubt if May 10th—the day on which the conference is scheduled to end—will bring any final agreement on this fundamental question.

Barriers

There are practical as well as ideological barriers to the degree of co-ordination which the Council of Europe has in mind. One possibility to be discussed at Strasbourg is that of interchangeability of aircraft (now a familiar part of the American airline scene), which is defined for the purpose of the Strasbourg agenda as "the ability of an airline, operating internationally under a government agreement or authorization, to use an aircraft belonging to a foreign airline and registered in a foreign State, with or without the aircraft's crew." Interchange of aircraft brings increased utilization and consequently reduces operating costs and, in turn, fares; but large-scale interchange throughout Europe's complex pattern of route networks would, for several years at least, be restricted by the diversity of types operated by different airlines. There are obvious limits to the extent of co-operation possible between two operators with, for instance, Viscounts and Convairs respectively.

Two other subjects on the agenda promise to provoke useful discussion: the possibility of granting special facilities for non-scheduled flights; and the future of helicopter services. Some agreement for smoothing the path of charter operators, in particular, is long overdue. The advantage of quick international shipment by air is too often nullified by the need to make a written application for landing rights some days in advance of the actual flight.

Apart from the withholding of traffic rights on many routes, there are several other factors which restrict the development of air transport in Europe. The greatest, and in our view the most easily reduced, is the amount of time and money wasted by Customs and immigration procedures based on those of seaports and frontiers. If these obstacles cannot yet be swept away they can at least be adapted to the requirements of the air age. And although Strasbourg may fail to settle the bigger political issues, it can exert a powerful influence in this respect alone.

Progress made at the conference will be reviewed in future issues of *Flight*. Meanwhile, we express a hope that members will find—in the words of Sir George Cribbett, leader of the British delegation—"a freedom which avoids chaos on the one hand and avoidable restrictions on the other."

FROM ALL QUARTERS

REAL WAR: Every French aircraft in Indo-China is furiously busy, either hauling supplies or hitting the Viet-Minh rebels. In the latter rôle are the Curtiss Helldivers from the carrier "Arromanches," now operating, as seen here, from a P.S.P. strip.

The Royal Homecoming

THE Royal Yacht *Britannia*, with Her Majesty the Queen and the Duke of Edinburgh on board, will be escorted throughout the journey from Gibraltar to the Thames Estuary by Shackletons, Neptunes and Sunderlands of R.A.F. Coastal Command. Up to latitude 41 deg 30 min north, escorts will be provided by Gibraltar squadrons; farther north they will come from England, and be under the control of A. V-M. T. C. Traill, A.O.C., No. 19 Group. During the first day and the last two days of the voyage, two aircraft will act as escorts during daylight and one by night; during the remainder of the time, one aircraft only will be in attendance by night and day. As the royal yacht leaves Gibraltar harbour she will further be escorted by six S-55 Whirlwinds, and aircraft from H.M.S. *Eagle* will fly past in salute.

On Saturday, May 15th, as *Britannia* steams up the Thames Estuary towards Woolwich, a mass formation of 180 jet aircraft will fly past in salute. The formation will consist of 96 Meteors and 24 Sabres of Fighter Command, 24 R.C.A.F. Sabres, and 36 Canberras of Bomber Command; there will be two broad arrowheads each of 72 fighters, followed by the Canberras in two groups of 18. They will pass Woolwich at 12.25 p.m., at 345 m.p.h. and staggered between 1,200ft and 3,000ft. Wings will form up over the East Coast and fly in *via* Clacton and Southend to Woolwich. After flying past the royal yacht they will continue westwards, dispersing over Ealing.

New British Fighters

MENTION can now be made of four new marks of British fighter, the de Havilland Sea Venom F AW.21 and Venom FB.4, and the Hawker/Armstrong Whitworth Sea Hawk F.2 and FB.3. The Venom FB.4 is a single-seat, Ghost-powered fighter/bomber for the Royal Air Force; it is very similar in appearance to the FB.1 and has internal improvements. The Sea Venom F AW.21 is a two-seat all-weather fighter for the Fleet Air Arm; it has improved controls, a power-jettisonable clear-vision canopy and a lengthened nose housing "more extensive" radar than is carried by the Mk 20; it is in production, as is the very similar Sea Venom 53 for the Royal Australian Navy. The new Sea Hawks are both Nene-powered and are in production by Armstrong Whitworth; both have numerous detail improvements about which nothing may yet be published.

French Indo-China Airlifts

AS we go to press the Franco-Vietnamese forces defending the Dien Bien Phu strong-point are still holding out, though the battle has reached a critical stage. By last Saturday the defenders lost all but 600 yards of their airstrip; the enemy claimed to be "in full control of both airfields at Dien Bien Phu."

Air support for the hard-pressed garrison last week became available on an increasing scale. Six C-124 Globemasters of the U.S.A.F. Tactical Air Command took some 820 French troops on board at Orly, Paris, and made an 8,500-mile flight *via* Karachi, Colombo, Bangkok and Saigon, thus avoiding Indian territory, the neutrality of which had been emphasized by Mr. Nehru, the Indian Prime Minister. It was reported that other airlifts were being organized from U.S.A.F. bases in North Africa.

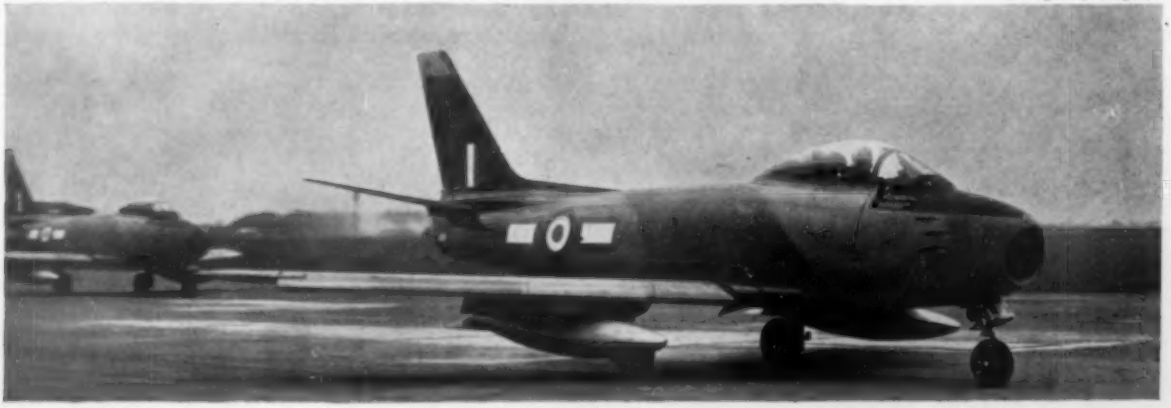
Whereas the Globemasters were to carry the troops to airfields in Indo-China outside the immediate area of the fighting, other aircraft—mainly C-47s supplied by America to the French forces—have been parachuting reinforcements and supplies direct into the beleaguered area. A remarkable fact is that the majority of troops thus lifted had never previously made a parachute descent; though they had received only the most rudimentary training, accidents were reported to be few and volunteers many. The majority of the drops have been made in darkness, and the pilots as well as the troops have had a formidable task, as the area is surrounded by 5,000ft mountains.

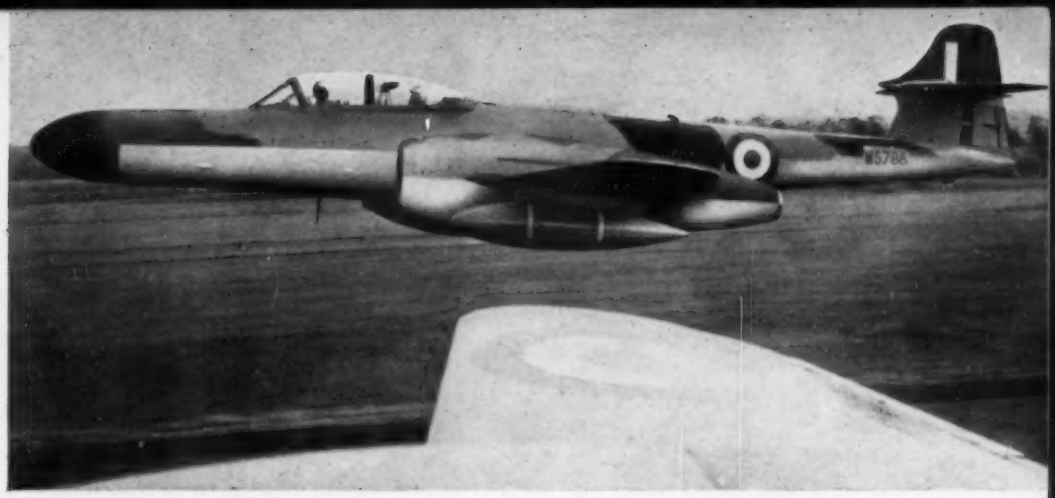
In spite of the ferrying-in of a considerable number of B-26s, the French say they are still seriously short of bombers. The whole problem of air support, too, has been complicated by several spells of bad weather, and these have also interfered with operations by the Helldiver squadrons which were disembarked from the French aircraft carrier *Arromanches* to operate from the Red River delta. On Monday last, 25 F4U-7 Corsair fighter/bombers, disembarked from the U.S. carrier *Saipan* on April 18th, went into action for the first time.

The only woman in the beleaguered garrison of Dien Bien Phu is a French Air Force nurse who has been marooned there since March 28th when the helicopter in which she had landed to evacuate wounded was destroyed by Viet Minh shellfire. Her name is Mlle. Geneviève de Galard-Terraube. It will be remembered that Mlle. Valérie André, a doctor and helicopter pilot, carried out similar duties in the same theatre of war.

YORKSHIRE SABRES: When the Canadian C.A.S., Air Marshal C. R. Slemon, visited R.C.A.F. North Luffenham recently (see p. 561), a regular Sabre squadron of Fighter Command dropped in on a visit. The aircraft are Sabre F.4s of a famous unit now based at Linton-on-Ouse.

"Flight" photograph





THE ULTIMATE? Ever since the first Gloster Meteor appeared to a 1940 specification, the type has been progressively developed to meet a variety of requirements. Perhaps the last basic type will be the 50ft-long Armstrong Whitworth Meteor NF.14, one of which is seen leaving the maker's airfield at Bitteswell. Incorporating the new radar and filleted fin of earlier marks, the NF.14 has a clear-view canopy and other modifications.

A Radar Association Gathering

SPEAKING at the recent eighth annual dinner of the Radar Association, Professor A. C. D. Lovell, O.B.E., B.Sc., Ph.D., F.Inst.P., said that he was amazed to find that, despite war-time development and use of radar navigational aids, there were still cases of aircraft crashing into hills. The Association, which was well equipped to function in the rôle of an advisory authority, should exert its influence in the maritime and aviation fields in an attempt to ensure that ships and aircraft were effectively equipped with radar navigational and safety devices.

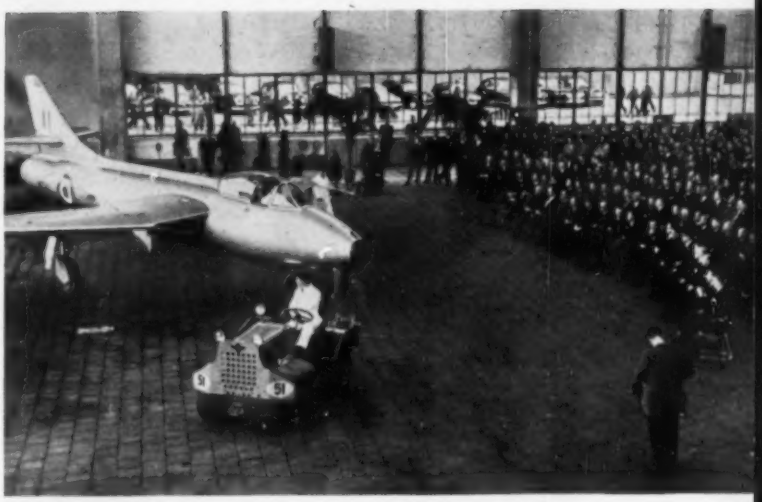
Air Chief Marshal Sir Philip Joubert, K.C.B., C.M.G., D.S.O., drew attention to the manœuvrability of modern bombers, which could turn "inside" the contemporary fighter, rendering it virtually useless as an interceptor. Fighter production lagged several years behind development. With the advent of the hydrogen bomb it was imperative that new methods of interception should be evolved, and among these early-warning radar must play a leading part. British science had given birth to the radar which played a vital part during the last war; now it must and would provide the equipment so essential to modern defence.

A.V-M. D. C. T. Bennett, C.B., C.B.E., D.S.O., F.R.Ae.S., president of the Association, welcomed the many distinguished guests at the dinner.

U.S.A.F. Contract for Flight Refuelling

IT was announced last week-end that the American subsidiary of Flight Refuelling, Ltd., has been awarded a £6m contract for the supply of flight refuelling equipment for the United States Air Force. Production will begin next month at the American company's Baltimore factory. The announcement of the contract follows the three-month visit to the U.S.A. made by Sir Alan Cobham, managing director of the British company, and extensive tests in that country of both the Flight Refuelling "probe and drogue" system and other methods.

An uncommon use of flight refuelling—in this instance, probably the "flying boom" system—was reported last week. A U.S.A.F. B-47E had landing-gear trouble when about to go into Fairford, Glos, and, standing off while the crew endeavoured to lower the undercarriage, reduced its fuel supply to a dangerously low level. In response to a radio call a KC-97 Stratotanker was airborne from Mildenhall, Suffolk, and the B-47 successfully refuelled. With plenty of fuel to spare, the bomber was then able to orbit at low altitude, and eventually the landing gear was successfully extended. A report that "the crew went through the emergency drill for lowering the undercarriage" suggests that resort was made to high-g turns, which would be more practicable at low altitude.



GUEST STAR: Having completed all 330 Meteors, the aircraft industries of Holland and Belgium are tooling up for a run of 460 Hunters and their Avon power units. At this ceremony at Schiphol the last two Meteors were handed over, and WT563, a production Hunter F.1 brought across by Frank Bullen, was shown to an interested audience which included Prince Bernhard of the Netherlands.

THE BIG HULLO: The crew of a U.S.A.F. Boeing KC-97G Stratotanker stand by their aircraft at Mildenhall, Suffolk, during a recent visit by A.T.C. cadets. It was a Mildenhall KC-97 which, as related on this page, fuelled a B-47E that was unable to land until an undercarriage fault had been rectified by the crew.

TWO NUMBERS TO NOTE

A Special Feature of next week's (May 7th) issue of *Flight* will be a fully illustrated historical review of the work of the aero-engine side of Rolls-Royce, Ltd., who are about to celebrate the 50th anniversary of the birth of a great partnership—the meeting of Henry Royce and the Hon. C. S. Rolls.

A Special Number of *Flight* is to appear three weeks hence, on May 21st—the annual Commercial Aviation number, containing features of value to airline operators and all others interested in the air-transport industry and its equipment.

SIKORSKY TODAY

New Helicopters Reviewed, with Special Reference to the S-56 and S-58

This unusual view of the S-56, or XHR2S, shows the general layout to advantage; the size of the hinged tail is rather emphasized, owing to perspective. The tailwheel-type undercarriage is down and locked.

WE lately received from the Editor a letter, postmarked New York, which began, "Excellent morning with Sikorsky. Saw a lot, heard a little, flew S-55, collected from P. and W. on 51 and flown to Heliport 2, Battery, N.Y. City after visit"—which is typical of the tempo of his past few weeks. The headquarters of the Sikorsky Division of the United Aircraft Corporation is at Bridgeport, Connecticut, and the Editor examined all their more recent developments, of which the two most important are the S-56 and S-58.

S-56—"So far as I can judge," he writes, "this is a magnificent machine." The basic design, he remarks, has been prepared to meet the requirements of the U.S. Marine Corps for an assault transport, and all present orders are for this version, designated HR2S. Four have been completed; of these, the third is about to fly, and one has been sent by barge to Philadelphia for airframe structural testing. The first prototype XHR2S flew on December 18th last, and was publicly demonstrated on January 18th. Production HR2S machines will be built in a new plant which is now being prepared in Stratford, a few miles from Bridgeport. The site is being levelled, and has an area of 300 acres; the factory itself will have a floor area of 600,000sq ft and will eventually employ 4,000, which means that it will virtually duplicate the main Sikorsky plant. Machines and stores are already being assembled so that production can begin in under 12 months' time.

As can be seen from our small sketch, the big helicopter has a single rotor driven by two engines. The difficulties inherent in this arrangement appear to have been well solved, and the XHR2S has a free-wheel system and a strong ("perhaps," writes the Editor, "over-strong") gearbox assembly. When fully developed, it may be possible to make the transmission lighter. The engines, which are Pratt and Whitney R-2800-50 18-cylinder radials of 1,900 b.h.p. each, are mounted in large nacelles carried well clear of the fuselage on stub wings. Each engine is toed inwards so that a straight-through drive is obtained to the main central gearbox.

The small hole in the nose of each nacelle admits air direct to the injection carburettors. The main cooling intakes are in the leading edges of the stub wings; the air, which is considerably assisted by ram-pressure in forward flight, passes first through oil coolers mounted Mosquito-fashion in the wing, and then enters the engine nacelle, augmented by a further flow from the inner side of each cowling. The flow is assisted by crankshaft-driven fans and is expelled to atmosphere along the outer skin of each nacelle.

The rotor, a fine piece of engineering, has five identical blades. Behaviour has so far been excellent, and stability and control are at least up to the competitive standard set by the S-55. Autorotation has not yet been fully explored but, owing to the high inertia of the rotor, is expected to be very good. The disc loading is exceptionally high, and Sikorsky consider this to approximate simply to a high wing-loading; the latter have always increased and, if properly provided for, have caused no trouble.

At Bridgeport it is believed that proper aerofoil tail surfaces and an aircraft-type fuselage pay big dividends in stability, as compared with the former circular-section boom. The stub wings, small as they are, give considerable lift in cruising flight. The large tailplane, with big trimming surfaces, is required by the disturbed airflow which extends to the rear of, and below, the main rotor, even in fast forward flight. The aircraft is trimmed by normal "elevator trimmer" controls, which alter the incidence of the elevator. There are, in addition, large moving surfaces in the trailing edge of each stub wing. Looking much like landing flaps, they are intended to reduce the dead area offered by the wing in conditions of low forward speed (climbing and hovering, in particular); there is some doubt about their effectiveness, and they may not be seen on production HR2S helicopters.

As can be seen, the aircraft has a retractable undercarriage, there being large single mainwheels, with brakes, and a single castoring, lockable tailwheel. Such an arrangement is virtually impossible with the old tail-boom layout; the S-51 has a nose-wheel-type undercarriage, whereas the S-55 has "one wheel at each corner"—an arrangement which has worked well. Sikorsky have no strong feelings regarding tricycle gear for helicopters; they consider that the Service requirement is usually dictated by an

Here seen during its tie-down tests a few weeks ago, the new S-58, or XHSS-1, anti-submarine helicopter is virtually a cross between the S-55 and S-56. It comes between the two in size, and combines the S-55 forward fuselage shape with the twin-engined machine's tail.

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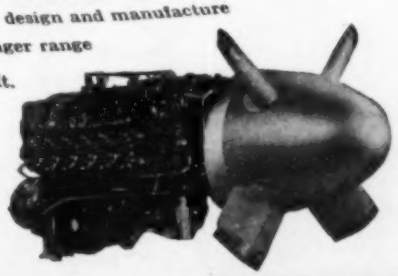

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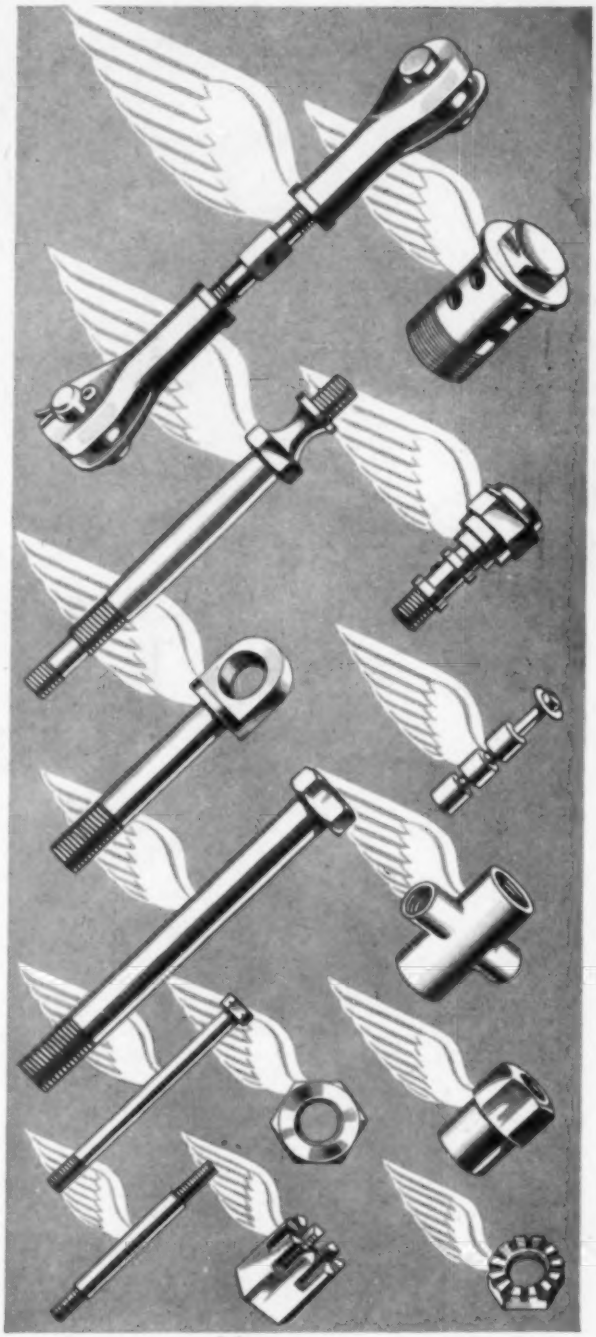

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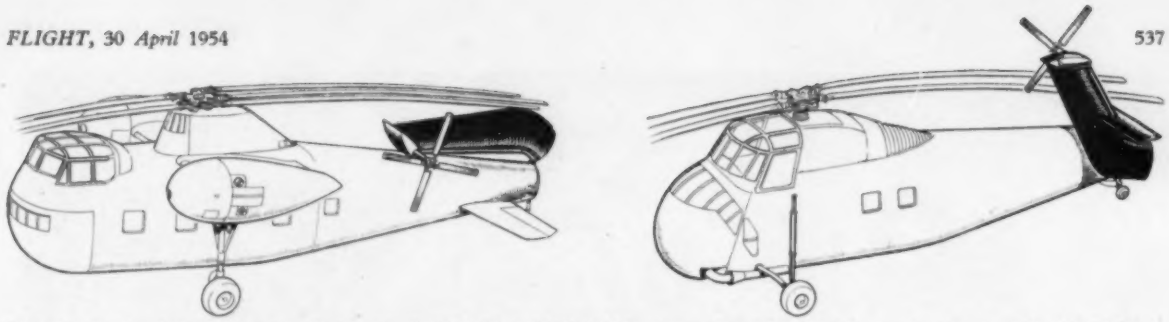


These perspective sketches show how the Sikorsky HR2S (left) and HSS (right) appear when fully folded for carrier stowage. The HSS might, in addition, be based on other types of ship, for operation from a platform.

SIKORSKY TODAY . . .

outlook which ignores the possible troubles of a new design until it is in use and then expresses a wish for the original. At any rate, the present "conventional" tailwheel-type undercarriage gives simple retraction, a good run-on and autorotational landing stability. It is noted that the appreciable difference in engine manifold pressure for given fast level-flight speeds with gear up and down indicates the importance of retraction.

One interesting point which arises at this juncture is the difficulty of providing an indication of undercarriage position for the pilot. No fixed-wing method of undercarriage warning applies, because landings are made at full power.

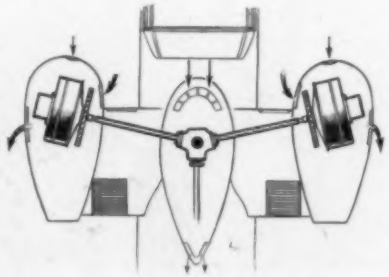
The cockpit itself is fairly conventional, and is very broad and roomy. Two pilots are seated side-by-side, as in the S-55. The control of two engines which are, in effect, coupled has posed few problems and should be attainable with a single collective-pitch lever on a single twist-grip throttle. On the other hand, overall power setting and synchronizing may require separate engine controls.

In the cockpit are control levers governing hydraulic jacks which open the large double nose-doors, fold the rear fuselage and tail rotor and also fold four of the five rotor blades, one blade being ranged due aft (the folded appearance of the HR2S is shown in a drawing). Micro-switches guard against inadvertent power-folding in flight. Access to the interior of the aircraft is gained *via* the large nose doors and two other doors on each side of the fuselage. The pilots normally enter by climbing up the outside of the nose, but they can also reach the cockpit from the main cabin by using a folding ladder. The noise level is approximately similar to that of a DC-3 at take off, although the rotor makes less noise than do airscrews absorbing the same power.

All fuel is carried in the stub wing, leaving the fuselage usefully free of obstructions and equipment. The normal load is to be two sections of U.S.M.C. assault troops (a total of 26) with equipment, or three small "Mighty Mite" Navy Jeeps, or combinations of other vehicles to a similar total bulk and weight. Provision made for all-weather flying includes extensive de-icing.

Civil interest is already considerable. Sikorsky have stated that the basic design could readily be converted into a 35-passenger commercial transport (the S-56) and Mohawk Airlines, of Ithaca, N.Y., have stated that they will eventually replace their DC-3s with helicopters of this size. These operators have already bought an S-55 (due for collection four days ago) for trial services this summer. The price was in the region of £53,500, exclusive of spares.

S-58—But for the almost simultaneous release of the later Model 56 (HR2S) this big anti-submarine machine, designated XHSS-1, would have received more publicity. It is generally agreed in the U.S. Navy that the present S-55, or HO4S, with either Pratt and Whitney Wasp (600 h.p.) or Wright R-1300 (800 h.p.) cannot do more than a marginal job in the anti-submarine rôle. Generally speaking, it is either a little low on equipment and stores or short of range. The S-58, which has been ordered as the HSS-1, will do the job very adequately.



The engine installation and main-rotor drive of the big Sikorksy HR2S, showing the main paths of cooling and engine air. The small trailing-edge flaps are discussed in the text.

Bigger than it looks in photographs, the new machine is a blending of S-55 shapes with those of the S-56. The power unit, which is mounted at 34 deg. in the nose, is the Lycoming-built Wright R-1820 Cyclone of 1,425 h.p. From the S-55 have come many features born of the immense experience gained on the smaller aircraft, but the basic design is quite new. The rear fuselage, for example, is of the new form, with a large fin. A tailwheel-type fixed undercarriage is fitted, and another item is a small fixed tailplane, apparently devoid of trimmers. The tail rotor has, unusually, four blades. The main rotor also has four blades, which can be folded by hand. The rear fuselage is also hinged, and folds as shown in the sketch above.

So far the U.S. Navy are the only Service with firm orders for aircraft of the S-58 family. On the other hand, Sikorsky are convinced there is little future in trying to stretch the S-55, and it is likely that large numbers of the new machine will be built to take over most S-55 work on a bigger scale.

S-57—(?) A secret Army project. Sikorsky are reported to have a number of convertiplane studies in various stages of development.

S-59—This type-number has been given to the S-52 four-seat helicopter fitted with a Continental-Turboméca Artouste turbo-prop of up to 400 h.p. We published the performance improvement achieved by this machine on p. 321 of our issue of March 12th.

S-54—Some time ago, Sikorsky made a careful study of twin-rotor configurations, as a result of which it was concluded that—in the present state of the art—there was little to be gained by having two rotors, but that a great deal of trouble and inefficiency might be expected. The loss of power to the Sikorsky tail rotor is small: about seven per cent at full power and half this in cruising flight. On the other hand, it was calculated that the overall loss of power in a twin-tandem-rotor helicopter would be about 12 per cent, owing to rotor interference. Sikorsky also consider that the use of two similar handed rotors is not efficient, except from the design and production viewpoint; in fact, different flows call for different rotors. Finally, the American engineers are of the opinion that stub wings on tandem-rotor helicopters are required just as much to improve stability as to unload the rotors and increase the possible cruising speed.

BROADCAST FROM A VISCOUNT

LISTENERS to the B.B.C. Home Service on April 20th were taken aboard that day's Ulster Flyer, the daily Viscount service which leaves London Airport at 7.20 p.m. and is scheduled to arrive at Nutts Corner, Belfast, at 9.5 p.m. On this occasion the aircraft was G-AMOA *George Vancouver*, commanded by Capt. Caesar-Gordon. It carried a full complement of 47 passengers, one of whom was B.B.C. commentator Raymond Baxter, broadcasting *via* the Viscount's normal Standard Telephones V.H.F. radio (using an off-airways frequency). Mr. Baxter gave regular reports on the progress of the flight. The quality of reception was such that he might well have been speaking from a studio, only a faint rush of air being audible in the background. The programme opened at 8.1 p.m., with the aircraft over Daventry and nearing the top of its climb to 21,000ft, and concluded 59 minutes later as it entered the circuit at Nutts Corner.

April 18th, incidentally, was the first anniversary of the Type 701 Viscount's introduction to scheduled service on the routes of B.E.A. Since then the size of the Viscount fleet has been increased from five aircraft to 20 and B.E.A. has brought turboprop travel to 27 cities in the United Kingdom, the Continent and the Mediterranean area. The fleet was extremely busy over the Easter holiday period. During nine days the 20 aircraft flew nearly 300,000 miles and carried more than 6,000 passengers. Over the same period there were 167 Viscount departures from the United Kingdom—145 of them from London Airport and 22 from Manchester and Birmingham.

AT BELFAST: Final assembly of English Electric Canberras at Short Bros. and Harland's works. Sunderlands are identifiable on the right.

HERE AND THERE

Speed Tradition

IN recognition of his Hawker Hunter speed records, S/L. Neville Duke is to receive the Royal Automobile Club's Segrave Trophy. The previous winner was Geoffrey Duke, the racing motor cyclist.

R.N.L.I. Helicopters?

THE Royal National Lifeboat Institution is investigating the possibilities of helicopters to serve as life-saving craft.

In Memory of a Test Pilot

NEXT Thursday, May 6th, at 12 noon, a Requiem Mass for the late Capt. J. Summers is to be held at the Church of the Jesuit Fathers, Farm Street, London, W.1.

Cotswolds Air Display

AN air display is to be held at Staverton, Gloucester, on Saturday, May 29th, by the local branches of the Royal Air Forces Association. It will be in aid of R.A.F.A. charities and the R.A.F. Benevolent Fund.

Notable Automobiles

SPECIFICATIONS of all current British cars, with performance data from road tests, will be among the features of next week's (May 7th) "British Cars for 1954" special number of *The Autocar*.

Early V.T.O.

AJIT MAITRA, chief commercial engineer of the Hindustan Aircraft Co., Bangalore, claims that he took out an Indian patent for a vertical-take-off aircraft in 1940. He made a preliminary application for a United States patent in 1951.

Keeping it Up

THE F.A.I. has confirmed a Soviet aeromodeller's claim to a duration record of 1 hr 31 min 41 sec for a radio model.

Cadet Expansion

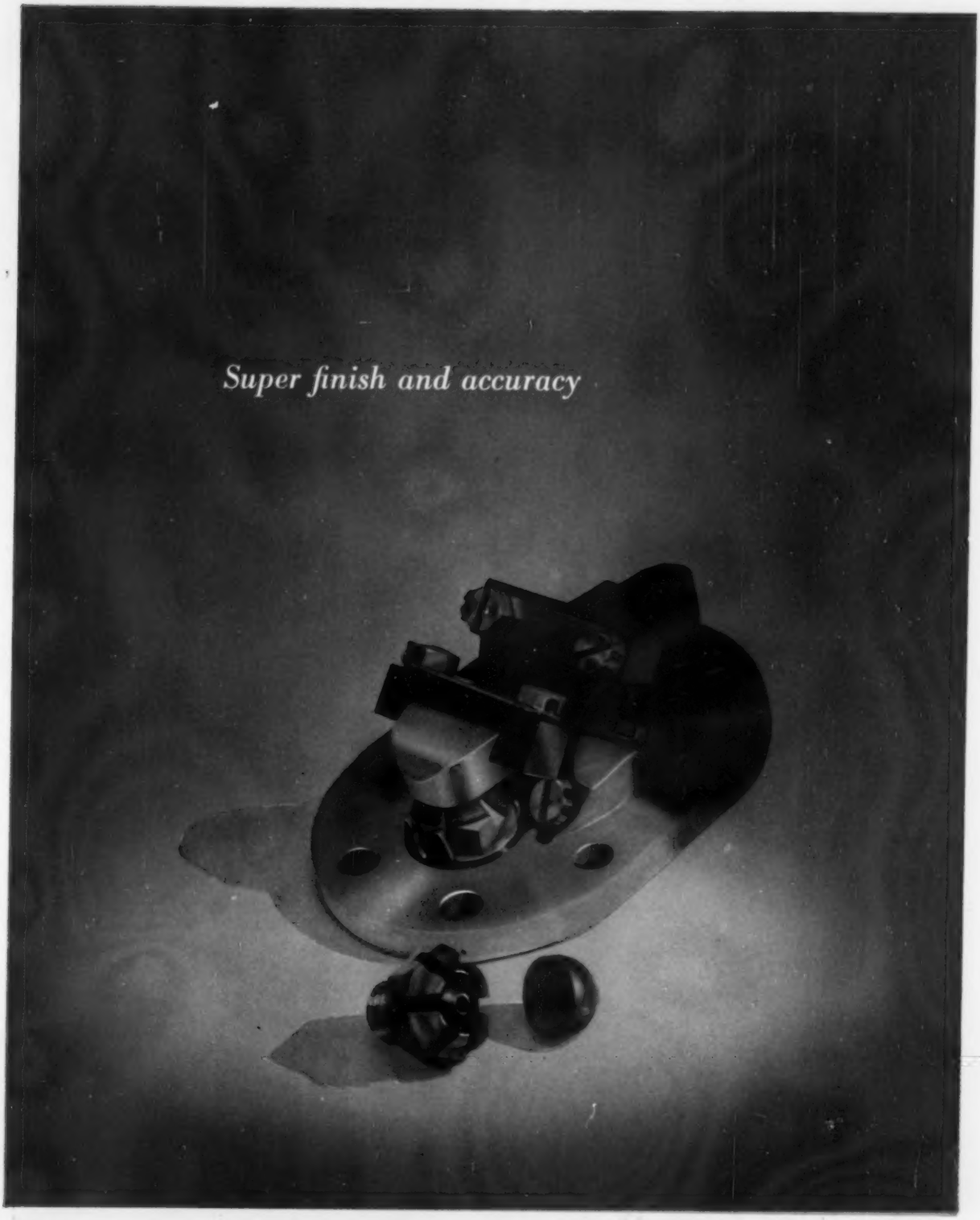
TWO new squadrons of the Air Cadet League of Canada are to be recruited in the Montreal area and staffed and supported by Canadair, Ltd. Two hundred boys between the ages of 14 and 19 will make up each squadron. The cadets are taught subjects which will fit them for eventual R.C.A.F. or civil airline service.

By Popular Request

IT is announced by the Royal Aeronautical Society that, as a result of many requests, a section lecture previously given last October by Mr. H. L. Cox, M.A., F.R.Ae.S., is to be repeated on Thursday, May 13th. The paper, *The Use of Materials in the Plastics Range*, will be given in the R.Ae.S. Library at 4, Hamilton Place, London, W.1, at 7 p.m.

AT BRISTOL: On a visit from Washington, where he is head of Technical Services, British Joint Services Mission, Mr. S. Scott-Hall discusses Bristol activities with Dr. A. E. Russell, director and chief aircraft designer.

AT BROUGH: Mr. Robert Blackburn (recovering from a fall on ice) was recently presented with a silver salver by Mr. W. A. Hargreaves, works director, on behalf of other Blackburn old-timers. (see p. 506, last week).



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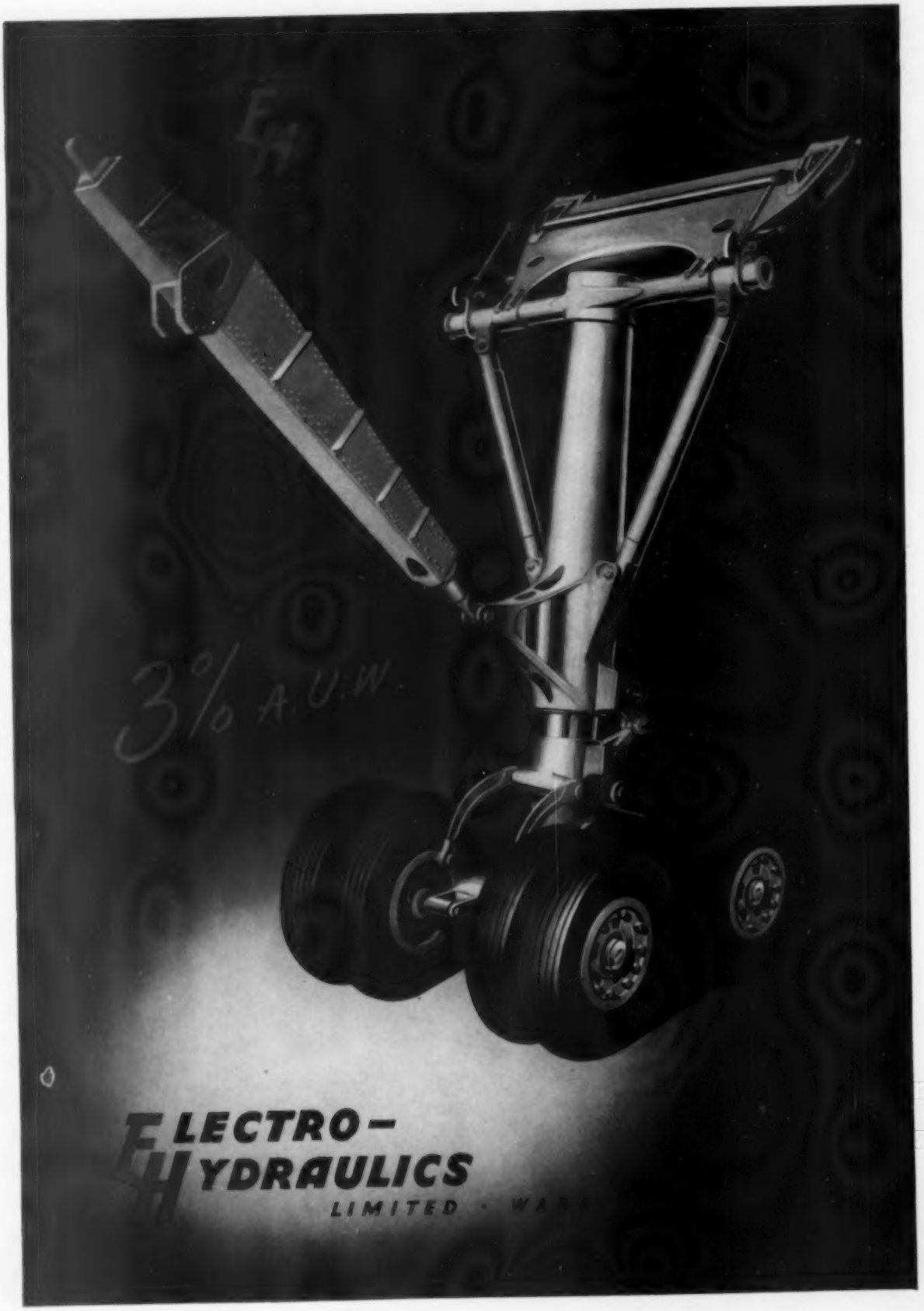
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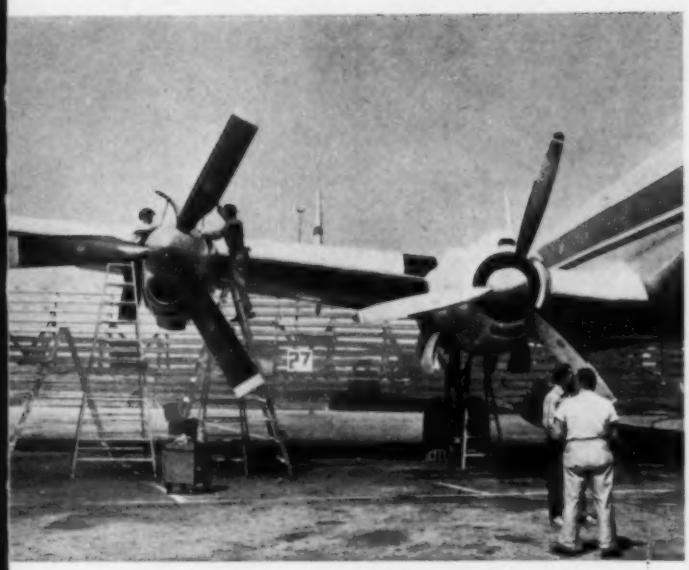


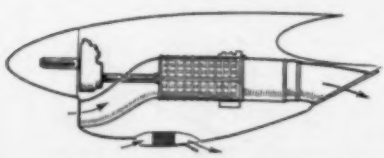
The YT56 is at present giving about 3,500 s.h.p., and looks hardly bigger than a cowled six-in-line engine of 350 h.p. The cowling is not vertical, but is tilted to remain at right angles to the dihedral-line of the wing. The aircraft, "Old 1961," is flying with three types of engine.

T56 TEST-BED

The Allison Engine for the C-130 Fitted to a Super Constellation

IT is well known that Lockheed are developing the basic Model 1049 Super Constellation into the Super Constellation 1249 and 1249B with turboprop power. These aircraft will have a slightly reduced wing span of 117ft, large tip tanks and a wing loading of 92 lb/sq ft or more. The power unit will be the Pratt and Whitney T34 which, as we said in our Power Units Number on April 9th, "can be considered the only fully developed engine in its class in the world"; it is a 5,700 h.p. turboprop, of single-shaft layout and driving a single three-blade airscrew, with immense blades of over 24in chord. Production of the civil 1249 will probably be preceded by the R7V-2 transport for the U.S. Navy, for which orders have already been placed. All these turboprop Super-Connies will cruise at something better than 400 m.p.h., if Lockheed estimates prove correct.

The aircraft illustrated on this page is not a Model 1249, but is the renowned "Old 1961," the first Constellation ever built (back in 1942) and since modified to incorporate every successive Constellation modification. When it was "stretched" to the 113ft length of a Super Constellation it became known as the 1961-S, and has since been termed "The Beast" owing to the fact that it sprouted all the tip-tankage and array of radomes to be found on high-flying barrier-radar WV-2s of the U.S. Navy (these have now been removed). At present, its power units consist of one 3,250 h.p. Wright Turbo Compound 972 TC (port outer), two 2,500 h.p. Pratt and Whitney R-2800 Double Wasps (both inners) and—the engine shown here—one Allison T56 turboprop in the starboard outer position. It may be remarked that Super Constellations now being built have four Turbo Compounds.



This simple sketch gives an indication of the layout of the T56 as it will be installed in the C-130. The duct at the bottom is probably for an oil cooler.

The T56 is not seen as a standard power unit for the Constellation, but is scheduled for service with the Lockheed C-130, the new assault transport of the U.S.A.F. This machine is a 400 m.p.h. high-wing design with a large door under the upswept rear fuselage. The undercarriage retracts, Me323-fashion, into the belly. Fully pressurized, the C-130 will have four T56s and should be "quite an airplane"; the prototype should fly next month and production is under way at the company's factory at Marietta, Georgia, where B-47s are also built.

Of the T56, little definite has been published beyond the fact that it is a turboprop developed from earlier Allison designs and that it has a design power of 3,750 s.h.p. The following can, however, be deduced with fair accuracy. It will be a single-shaft engine, with a compression ratio of about 7:1 and a specific fuel consumption of about 0.6 lb/hr/ehp at take off, falling to less than 0.5 at the best high-altitude cruise point. It is, in particular, certain to be very small and compact in relation to its power.

One of the first flight-cleared YT56 engines has now been installed in Super Constellation "1961-S" approximating, as nearly as possible, to the installation of the production engine in the C-130. The C-130 control system has been employed, and this is probably an electronic arrangement by Aeroproducts. As the photographs show, the installation is quite remarkable for its neatness and small frontal area; the engine is rendered accessible by the large side doors, hinged at the top, with the general layout as shown in our sketch. Accessories are disposed on the rear sides of the engine while the airscrew is driven through the large separate reduction gear, as was the case in the installation of the earlier Allison T38 turboprop in the Convair Turbo-Liner.

The airscrew is a Curtiss Turbolectric unit, with three forged and extruded hollow-steel blades, each some 18in in chord. Full thermal anti-icing is provided both on the airscrew and engine. One point of particular interest is the fact that—in common with many other American aircraft—the starter motor is a small compressed-air turbine geared down to the main engine. Once one turboprop has been started it is probable that its compressor can be tapped to provide air for the starters of the other three engines (in the C-130A, that is). At present, a Continental-Turboméca Palouste MA-1 air compressor set is used as a ground trolley to supply air for starting. Part of its delivery pipe can be seen in one photograph, attached to the underside of the wing.

THRUST TO DRAG

Boeing Reveal Details of their Thrust-reversal Research

IT has long been known that the Boeing Airplane Company, of Seattle, have been conducting extensive investigations into the whole subject of turbojet reverse-thrust devices. Some details of this work have now been made public.

The company began their serious studies of jet transport aircraft at about the same time that the reverse-pitch airscrew came into general use in America (1951). Several hundred (we believe, over 1,000) transports are now in service with braking airscrews, both with military and civil operators. Such devices can offer a greater deceleration than can brakes alone (without an anti-skid device) and, on icy runways, can be invaluable. No such reverse-thrust can, of course, benefit the turbojet aircraft—indeed, only with difficulty can a reverse-pitch airscrew be applied to a turboprop.

Many companies, therefore, turned their attention to the problems involved in deflecting the efflux from a turbojet so as to destroy, or even reverse, the resultant thrust on the aircraft. The first such installation was, we believe, made on a Whittle turbojet mounted in the tail of a Wellington test bed; this was at Bitteswell in 1945. The first company to publish mechanical details of such a device was the French nationalized group S.N.E.C.M.A. who, in 1952, showed their deviator in illustrations, and demonstrated it fitted to a Goblin-Vampire last summer. An advantage of the French *deviateur de jet* is that it can be used "in full flight" as an air brake and has, in fact, actually been tested up to Mach 0.9.

Boeing, on the other hand, have been almost exclusively interested in meeting the most severe landing case, in which the aircraft lands at maximum landing weight (or higher) in such conditions of runway surface that the wheel brakes lose much, or all, of their effectiveness. The variables are: wheel brakes, reverse thrust, drag chutes (parachutes streamed from the aircraft approximately at the moment of touch-down), and other possibles, such as arrester wires, drag chains or barriers, and forward-firing rocket bottles. Wires, barriers and rockets, while in service with some military units, are hardly thought to be applicable to commercial operations.

The greatest drawback to the braking parachute is its "one-shot" characteristic, i.e. once streamed it cannot be used again until it has been jettisoned, recovered, inspected and repacked by a skilled crew. Canopy life is also short and, although B-47 units calculate that the chute more than pays for itself as a result of decreased brake and tyre wear, it is not looked upon with favour by commercial operators. Furthermore, its effect falls off rapidly with decreasing airspeed.

Braking-parachute performance can be equalled by a reverse-thrust of only some 25 per cent, i.e. a decelerating force equal to one-quarter of the normal thrust available at take off. According to Boeing calculations, the following ground-run data might apply to a jet transport (Boeing only presented the data qualitatively, and we have assigned definite values in the same proportion, which might refer to the Boeing Stratoliner/Stratotanker): dry runway, brakes only, 3,900ft; icy runway: brakes only, 8,300ft; brakes, plus 32ft chute, 5,900ft; brakes, plus 25 per cent reverse thrust, 5,100ft; brakes, plus aerodynamic braking, plus 25 per cent reverse thrust, 4,600ft; brakes, plus 50 per cent reverse thrust, 4,000ft.

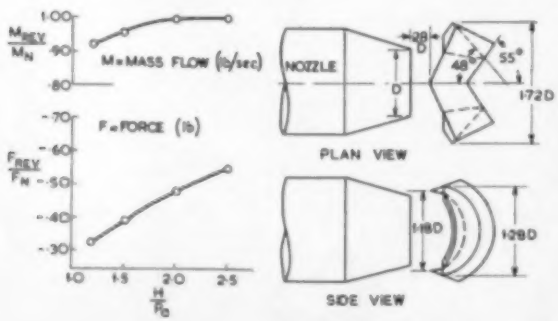
The factors affecting the design of a jet thrust-reverser are conflicting and, as is often the case, the resulting configuration is a closely-controlled compromise. Factors which were considered to be mandatory were: the elimination of difficulties which had been met with reverse-pitch airscrews (presumably such troubles as inadvertent thrust reversal following electrical failure or pilot-error), design for maximum reliability, the incorporation of a "fail-safe" characteristic, and the fact that no reduction in engine life and no adverse effect on engine behaviour or acceleration could be tolerated. Some weight penalty had to be accepted in order to provide clean stowage for the reverser when not in use.

Initially, a large number of general shapes and sizes of reverser were tested in a simple laboratory rig to determine performance, the net reactive force of nozzle plus reverser being measured by a strain-gauged cantilever arm, the accuracy being within ± 2 per cent absolute, and with general repeatability within ± 1 per cent. The overall results are shown in the accompanying curves, the function H/P_a being the ratio of nozzle total head to ambient pressure, this parameter being varied within the range 1.5 to 3; most modern turbojets have an H/P_a value of about 2 at sea-level full power. Although the testing was cold, it is felt that the results are indicative of performance obtainable with a hot jet having a lower specific flow at higher velocity.

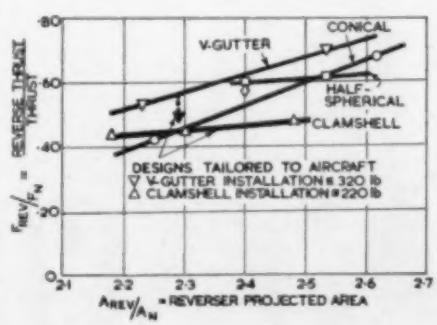
The three basic types of reverser which showed most promise were: the conical V, visualized as a folded-leaf package to be extended from the nozzle inner cone on a long rod and opened when clear of the jet nozzle; the V gutter, visualized as a vee-channel formed from two flat plates hinged together along their longer edges and stowed in the strut supporting a jet pod; and the clamshell W, which is the type shown in our drawing on the opposite page.

The clamshell W consists of two hinged deflectors which, when retracted, form part of the rear outer skin of a turbojet tailpipe cowling. The unit can, in fact, be applied to a pod, or to the rear-fuselage of a fighter, or to engines buried in the root of a wing; in the latter case, the two panels of each reverser would be hinged about horizontal axes so as to deflect the jet above and below the wing, whereas the other applications can best be met by a reverser having left- and right-hand portions. Each of the main components is hinged to the nozzle and actuated by a separate jack, as shown in the drawing. Each panel carries, hinged on its inner edge, an additional baffle plate which deflects the jet forwards through a mean total angle of about 125 deg.

It is surprising to note that Boeing found better results with simple V and U gutters with boxed-in ends than could be obtained with theoretically more efficient half-spherical reversers; it was considered that, with the latter, nozzle interference with the reversed fl. *w* was excessive. The Boeing report goes on to give details of the variation in performance



(Left) The final configuration of the Boeing clamshell reverser, with curves of mass flow and proportional reverse thrust plotted against nozzle pressure ratio.

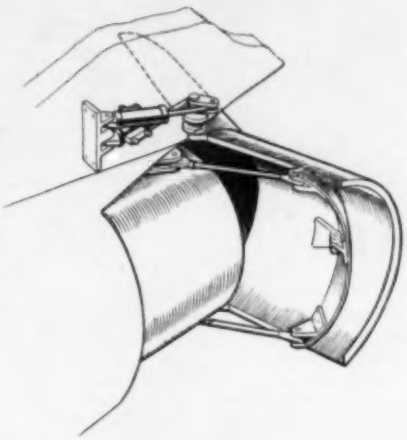


(Right) Comparative performance of selected types of reverser.

obtained by altering the reverser geometry. Generally, it appeared that, provided the entire mass flow was captured by the reverser, the reverse thrust was largely a function of reverser projected area. Thus, the optimum value of $F_{rev}/F_n = 0.83$ (a remarkably high value, in our opinion) was obtained with a V-gutter area nearly three times the nozzle throat area. Experiments showed that gutters of equal projected area gave similar results, irrespective of cross-section.

Several types of W clamshell reverser were examined, and one of our drawings shows the final configuration. As the curves show, about 50 per cent reverse thrust is obtained at the full-power H/P value of 2, and the restriction at nozzle pressure-ratios corresponding to acceleration conditions was considered acceptable. The weight of this reverser installed on a single podded engine was, at some 220 lb, 100 lb lighter than a V-gutter, largely owing to the reduced actuation stroke.

Glide-path control with reversers in operation was not contemplated, as reverse-thrust was considered unnecessary except on the runway. It was, therefore, concluded that stability problems would be, at worst, no greater than had been experienced with braking airscrews. Normal turbojet control systems guard against bad behaviour during acceleration and other difficult conditions, and the effect of the V and W reversers, as they stand, is not thought [by the engine company—presumably Pratt and Whitney] to be a problem. No trouble is expected from temperature in the actuation bay, or from maintenance of the actuators or basic power plant.



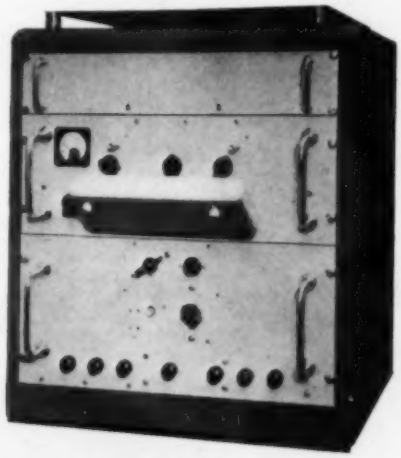
A typical installation of a clamshell W reverser in a single podded turbojet. With suitable modifications the same type of unit can be applied to a double pod, or to a single-engine fighter, or even to engines buried in the wing after our own formula.

At present, therefore, Boeing are beginning an extensive programme of flight testing various forms of reverser in B-47s and other aircraft, preparatory to fitting the units to B-52s and transports. The prototype Stratotanker will not have reverse thrust, but it is to be standard on production machines.

INEXPENSIVE RADIO BEACON

THE firm of Redifon, Ltd. (Broomhill Road, London, S.E.18), number beacons among their aeronautical radio products, and it is their claim that the Redifon 100-Watt beacon as supplied to the M.T.C.A. is used almost exclusively throughout Great Britain. In introducing their latest automatic medium-frequency locator beacon and route-marker—the G.142—they state that they have produced a thoroughly reliable beacon which costs much less than is usual for this type of equipment.

The G.142 provides an output of 80 Watts to the aerial circuit over a frequency range of 200-420 kc/s, and is suitable for operation from either 100-125 or 200-250 volts, 50 or 60 cycles, single phase A.C. supply. A dual beacon is available to ensure continuous operation: this installation includes two transmitters, each with a power unit, and a change-over device automatically switches-in the reserve transmitter should the one in use cease to radiate correct signals at the full carrier power with adequate modulation. In the event of an A.C. mains supply failure an alternator driven by either a diesel or petrol engine is automatically started.



The new Redifon beacon. This photograph shows a single installation comprising power unit, modulator, and automatic code sender.

The single transmitter installation, mounted in a standard 19in rack, comprises power unit, modulator with automatic code sender, and R.F. unit. It weighs 183 lb and is 1ft 10in wide, 2ft deep, and 2ft 2in high. The height of the dual installation is 4ft and its weight 365 lb. The equipment can be supplied fitted in a weatherproof, ventilated kiosk-type of housing, which eliminates the need for a building.

PAT REID

FROM Esso Export Corporation, New York, we learn with regret that among the 35 occupants of the T.C.A. North Star who lost their lives when the airliner was in collision with an R.C.A.F. Harvard near Moose Jaw on April 8th was T. M. ("Pat") Reid. His wife was also killed in the accident.

Born in Ireland 59 years ago, Reid had an unusually colourful career in aviation, which began when he joined the R.N.A.S. in 1915. He flew in the Dardanelles, Salonica and France, and was awarded the D.F.M.

After the war he was with Handley-Page Transport on the early London-Paris-Amsterdam-Brussels route, and became their superintendent of engine overhaul at Croydon, and later their manager in Switzerland. Upon arrival in Canada in 1924, he joined the Ontario Provincial Air Service and flew forest fire detection and suppression patrols until 1927.

For the next two years Reid was in charge of remote exploration for the Northern Aerial Mineral Exploration Company, making many pioneer flights in the Far North. In the winter of 1929-30 he participated in the search for Carl Ben Eielson, who lost his life whilst flying within the Arctic Circle.

Reid joined Imperial Oil, Ltd., in 1931 as western aviation manager and in the following year was made the company's aviation representative. Later he became aviation sales manager for Imperial Oil, Esso's marketing affiliate in Canada. At the time of his death he had been flying the company's aircraft for 23 years. He was awarded the McKee Trophy for 1942-43 "in recognition of 20 years of competent and enthusiastic service to aviation."

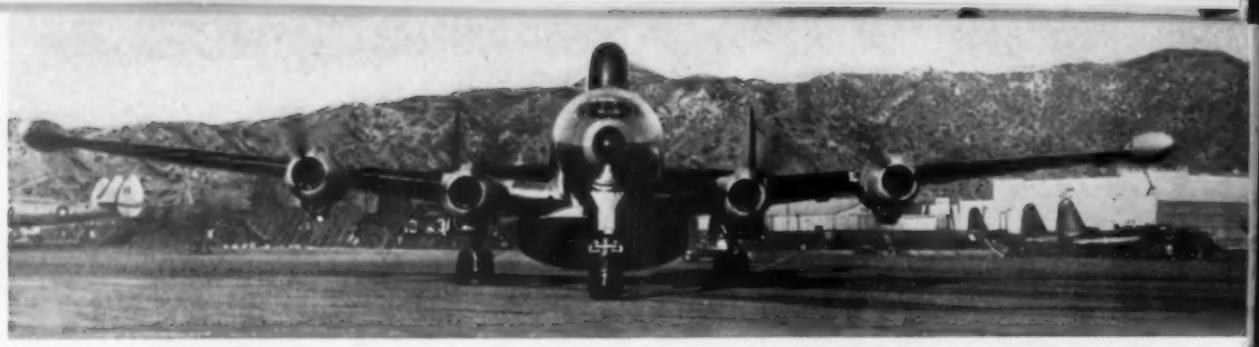
Mr. and Mrs. Reid are survived by a son, F/L. John E. Reid, an R.C.A.F. pilot.

RADAR FENCES

SEVERAL early warning radar systems are being set up to cover the northern approaches to North America. One, known as the McGill Fence, was initiated last November, and the stations are now under construction on sites beyond the populated areas of Northern Canada. Some problems have to be overcome in construction because of the inaccessibility of many of the sites and the extreme temperatures encountered over much of the year. Technical problems, such as the interference of the Auroral belt with radar transmissions, are also to be expected.

Another network is the Pinetree Chain, a system of early warning stations extending outwards from the principal industrial centres of the United States. This system, begun four years ago, is now partly in operation. According to geographical location, the chain is operated by U.S.A.F. or R.C.A.F. personnel.

"Flank coverage" is provided by co-ordinated systems covering the north-western and north-eastern approaches to the United States, such as the Alaskan and Aleutian chains. These systems will soon be supplemented by the use of Super Constellation early warning aircraft of the type illustrated overleaf.



ADIPOSE SUPER-CONSTELLATION: The U.S. Navy's Lockheed WV-2 early-warning aircraft, referred to below.

AIRCRAFT INTELLIGENCE

Great Britain

De Havilland Venom. Following the recent discovery of a small crack beneath a butt joint in the upper wing skin of a Venom night fighter, Sea Venom FAW. 20s were temporarily grounded, and a speed limit was imposed on R.A.F. Venom NF. 2s. A minor modification was immediately introduced, consisting of a small reinforcing plate rivetted over the affected section—the rear of the undercarriage bay. A considerable number of Venom FB. 1s are in service with 2nd T.A.F., and a much smaller number of Venom NF. 2s with Fighter Command. Only one squadron of Sea Venom FAW. 20s has so far been formed, No. 890, at R.N.A.S. Yeovilton.

Vickers Armstrongs Nene-Viking. This modified Viking, which was originally ordered by the Ministry of Supply for research, is now being re-converted to Viking 1B standard and will be operated by Eagle Aviation, Ltd., with the registration G-AJPH.

U.S.A.

Douglas Skyshark. The El Segundo division has completed about half of the reduced order for ten Skysharks. The order was cut after development troubles occurred with the gearing and airscrew controls of the Allison T40 turboprop. The same division has also completed the first production F4D Skyray.

Grumman F9F-9. With this designation Grumman are building a light fighter for the U.S. Navy. It is reported "to bear no resemblance" to previous F9Fs.

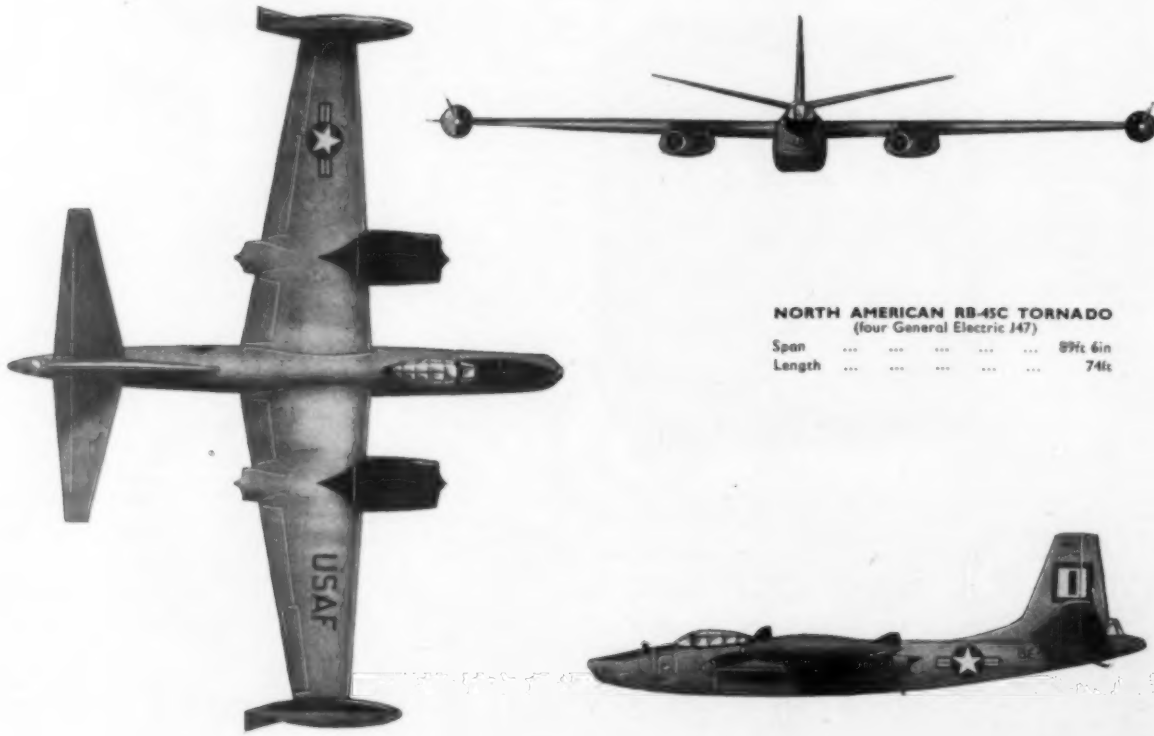
Lockheed XFV-1. Recent photographs of the Lockheed V.T.O. fighter show it taxying with a temporary horizontal undercarriage (shown in *Flight*, March 26th) and with the spinner at the blade roots removed. The nose cone of the spinner is still in position and is, in fact, a radome.

Lockheed WV-2. The first of these Super Constellation radar early-warning aircraft (picture above) was delivered to Squadron VW.1 at Pearl Harbour recently. The aircraft, which was developed from experimental WV-1 Constellations, is basically a Super Constellation fitted with an 11ft-high height-finding aerial above the fuselage and, below it, the largest plastic radome ever built. A crew of 31 can be carried in the pressurized cabin, with cooking and rest facilities. Some of these men are maintenance personnel to service the elaborate equipment during the long defensive radar patrols. The excrescences it is said, do not seriously affect performance. Unlike the projected maritime Britannia, the WV-2 carries no offensive armament. U.S.A.F. designation of the WV-2 is RC-121C.

France

Foreign Interest. A Swedish mission recently visited France and inspected the Marcel Dassault Mystère IV, the Fouga CM.170 Magister and the Potez 75 ground-attack aircraft. Mr. Fryklind, a Swedish test pilot who was in attendance, flew the Magister and the Potez 75, and was particularly impressed with the latter's rough-ground undercarriage, which is designed for taxying even on newly-broken surfaces.

Payen. The tiny Payen Pa 49 research aircraft has now completed its 10-hour manufacturer's test programme and has been handed over to Lt. Ferringo of the Centre d'Essais en Vol at Brétigny. It is reported that the retractable undercarriage which it was originally intended to fit may be installed shortly.



NORTH AMERICAN RB-45C TORNADO
(four General Electric J47)

Span	89ft 6in
Length	74ft

Roy Nockolds' design to illustrate "Endurance", upon which depends the effective striking power of fleets at sea, the forewarning of attack . . . the safety of aircrews and their aircraft. Endurance is a factor which aircraft designers have long sought to reconcile with high performance; the Double Mamba turboprop has been designed to meet this requirement.

THE DOUBLE MAMBA Basically two Mamba engines side by side driving independent co-axial four-bladed airscrews, the Double Mamba develops 2,950 e.s.h.p. Each unit is entirely separate; neither can be affected by loss of power or injury to the other. Specially designed for deck-landing aircraft,★ the Double Mamba has the power potential, handling qualities and safety factors of a twin-engined aircraft, combined with the fuel economy and stowing facilities of a single installation.

★ *The Fairey Gannet — super-priority for the Royal Navy — is powered by the Double Mamba.*

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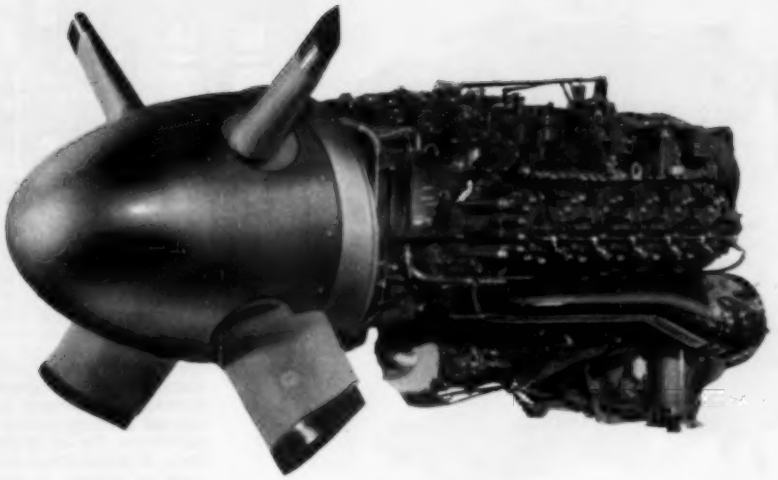


NAPIER NOMAD

An Engine of Outstanding Efficiency

A STUDY of the development of aero engines during the past fifty years brings to light the rather remarkable fact that, whereas immense strides have been made in improving power/weight ratio, overhaul life and reliability, comparatively little has been done to improve thermal efficiency or specific fuel-consumption. Today, in fact, piston engines are scarcely 20 per cent better in these respects than they were in the 1914-18 war. The advent of gas-turbine power has not materially affected the overall position; while accelerating the improvement of power/weight ratios and holding forth promise of very good trouble-free life in the years to come, the gas turbine has made little contribution towards overall efficiency—in fact, the earliest turbojets were, in this respect, decidedly retrograde.

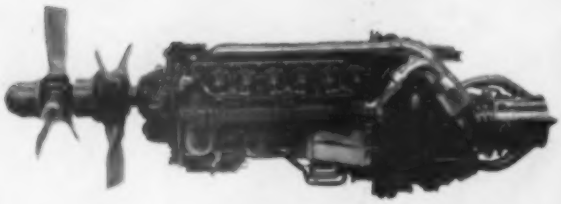
This seeming lack of progress is by no means due to want of effort. The need for increased efficiency has always been clear enough, and is today of transcendent importance both to the military logistics planner and to the airline operator. To some extent, also, better power-unit efficiency is desirable to permit increased aircraft range or duration. But every engineer or company that has set out to achieve a *significant* improvement in fuel consumption has, sooner or later, given up the unequal struggle against weight, complexity and unreliability.

Without going too deeply into thermodynamics, it may be said that the basic aim of the engine designer is roughly as follows: the working fluid (air, or hot gas, in aero engines) should initially be as cold as possible; it is then compressed as much as is practicable, in an adiabatic manner, so that heat losses are minimized; finally it is expanded and cooled as nearly as possible back to its original condition, and is made to do useful work during the latter part of the cycle. The relatively poor efficiency of most aero engines results from insufficient compression and expansion ratio, and insufficient cooling of the working fluid before expulsion back to atmosphere; even in highly boosted engines with adequate peak temperatures and pressures, the exhaust is discarded while still very hot and at high pressure. At full throttle, about three-quarters of the heat energy originally released by burning the fuel is wasted by reason of the fact that the exhaust is released too soon.

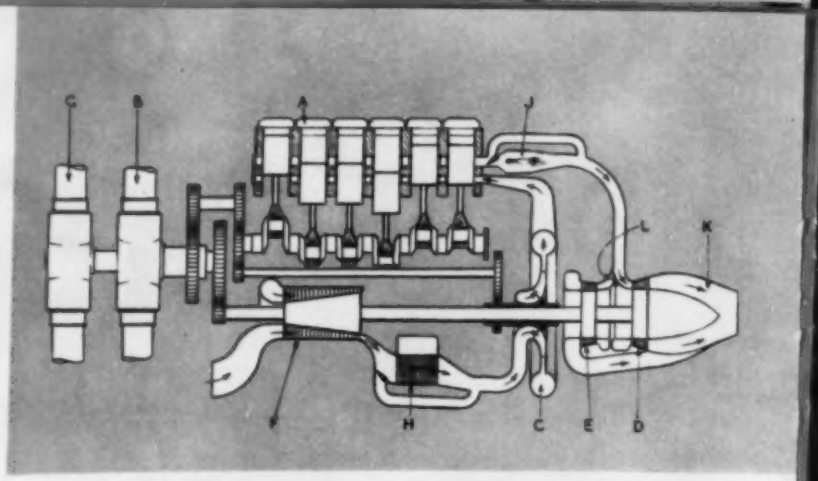
Innumerable methods have been adopted to reduce such waste. Accepting an inefficient power unit as a *fait accompli*, some improvement can be made by employing ejector exhaust-stacks or, better, by extracting some of the exhaust energy by inserting a turbine in the gas stream and turning the shaft power to good account, either by making it drive a supercharger or by gearing the rotor to the crankshaft. Alternatively, a fresh start can be made on an engine with a revised thermodynamic cycle, such as a compound engine, or a diesel unit, or a more complex affair with various compressors, heat-exchangers and intercoolers. All these have been tried, but the insistent demands of installed weight, simplicity, low first cost and high reliability have been strong enough to confine the propulsion of aircraft to essentially simple engines, whether of the reciprocating or turbine type.

Now, however, an engine has been developed which is likely to see wide service in both military and civil rôles as a result of its unmatched efficiency; in fact, its overall efficiency is of an altogether higher order than that achieved by any other aero engine. Particularly remarkable is the fact that, in spite of this unrivalled economy, the engine is extremely competitive in all other parameters, including power/weight ratio, complexity, bulk, altitude performance, flexibility and control, and ease of installation. Further, it can burn a wide range of fuels (not only accepted aircraft fuels) and it is likely that its overhaul time, overall life and reliability will be of an exceptionally high order. This engine, the Napier Nomad, is the result of many years' development by a British company, D. Napier and Son, Ltd. From a technical standpoint it is one of the most interesting aero engines ever designed, and the narrative which follows is accordingly the most extensive engine description that we have ever published.

The germ of the idea grew from an official specification of 1944-45 calling for a 6,000 h.p. engine; this was, of course, the size which might have been required had the war continued, and gas-turbine development—especially of shaft-drive engines—was still in its infancy. The specification was written around a four-stroke piston engine, but Napiers (with whom we may couple the name of Mr. E. E. Chatterton, B.Sc.(Eng.), M.I.Mech.E., F.R.Ae.S., now chief engineer of the piston-engine division) were studying the promise of a compound unit incorporating a two-stroke diesel engine.



Two distinct stages in Nomad development are shown by these scale photographs of the E.125 engine (above) and the present E.145 Nomad (below).



The layout of the original Nomad is shown above diagrammatically; redesign eliminated the centrifugal compressor, auxiliary turbine, and combustion chambers and forward airscrew, while other modifications increased the cylinder capacity, turbine output and compressor efficiency, and reduced heat-losses. The key to the diagram is as follows: A, one cylinder block (of two); B, piston-driven airscrew; C, delivery from centrifugal impeller; D, main gas turbine; E, auxiliary turbine; F, axial compressor; G, turbine-driven airscrew; H, projected heat-exchanger; J, auxiliary combustion chamber; K, tailpipe; L, flap valve.

NAPIER NOMAD . . .

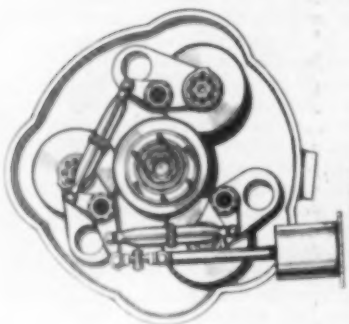
The first project was a big 24-cylinder "H-type" diesel of some 75 litres capacity, with two crankshafts each driven by cylinder blocks 150 deg apart; had the two sets of cylinders been directly opposed there would have been no room for exhaust ducting. The work progressed to the stage at which single- and two-cylinder units were being run on test rigs, while the axial compressor was tested by the surplus steam-turbine capacity of a Northampton power station—which, under M.o.S. authority, was also used in the development of some of our earliest gas turbines. Then, in 1946, Napiers decided against the 6,000 h.p. project; instead, the 75-litre unit was, figuratively speaking, cut in half to form a horizontally-opposed 3,000 h.p. engine for which a wider range of applications was envisaged.

The resulting twelve-cylinder unit became the first Nomad; it is illustrated both photographically and diagrammatically above. The two main rotating parts of the engine, the crankshaft and the compressor/turbine assembly, were connected only by the gas flow, and each section drove its own airscrew. During 1948 the compressor and turbine assemblies were cold-tested, and it is worth noting that the axial compressor was very similar to that of the Naiad turboprop. By 1949 the Nomad prototype was running as a complete unit.

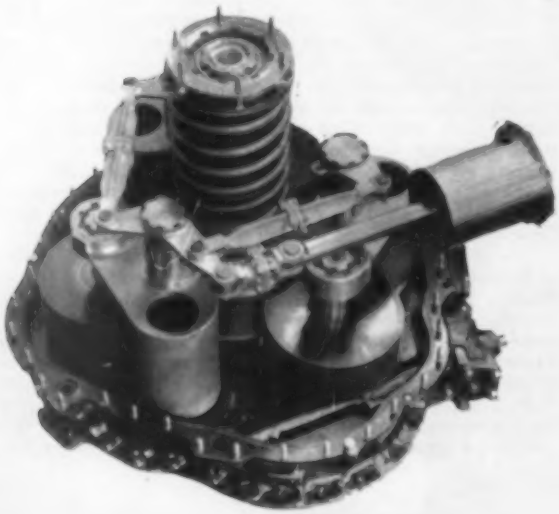
The original working cycle required about 6½ ata boost and, as this pressure could not be obtained with an axial compressor alone (at that time), a centrifugal compressor was added in series, driven from the crankshaft. The centrifugal blower was also essential during starting, owing to the inflexibility of early axial units; actually, the first axial was designed to give a pressure ratio of about 5.5:1, and an intercooler was projected but not used.

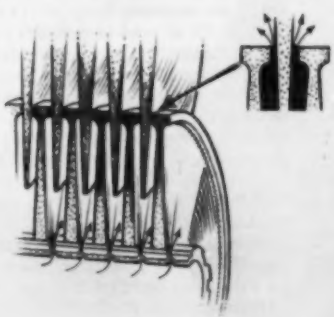
The thermodynamic cycle proposed was that heat would be added to the air until the combustion temperature in the diesel cylinder reached 2,500 deg C; the gas would then be cooled by doing work, and would finally be exhausted at atmospheric pressure by expansion across the turbine. A two-stroke cycle was chosen with compression ignition, and with a PV curve for the reciprocating component fairly typical of modern diesels. Compared with a turboprop, the Nomad provided very much greater compression and expansion ratios, as well as greater peak pressures and temperatures: for example, the overall air/fuel ratio of a turboprop is normally of the order of 100:1, while the corresponding figure for the Nomad was about 40:1 overall (including scavenging) and 28:1 in the cylinder. Even the fresh scavenge air was by no means wasted, as this was in any case needed to reduce the gas temperature to that permitted at the turbine inlet.

Regarding air compression, the initial compression was split roughly equally between the axial and the centrifugal units, the overall pressure ratio being about 11.3:1, resulting in a maximum boost of 95.5 lb/sq in absolute. This unprecedented supercharge in turn kept down the fixed-displacement compression in the cylinder to 8:1; nevertheless, the peak cylinder-pressure of over



The variable-ratio gear is diagrammatically and photographically illustrated on the left and below. In the diagram, the boost-control piston pivots the planetary arms about fulcrums shown in solid black.

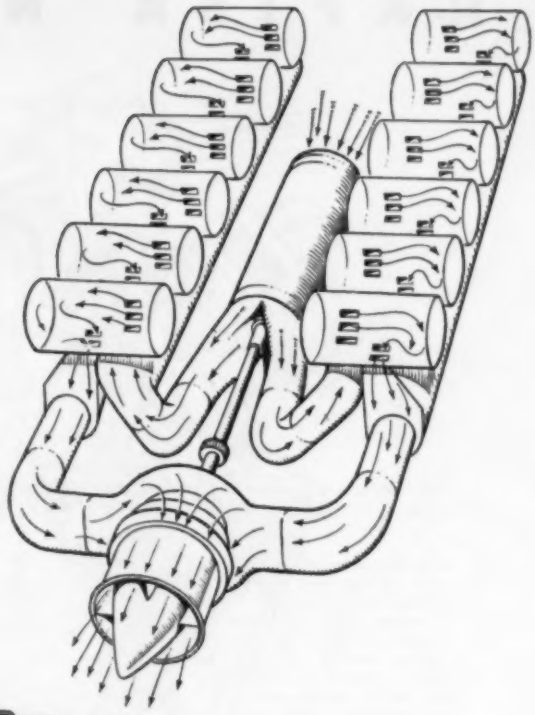


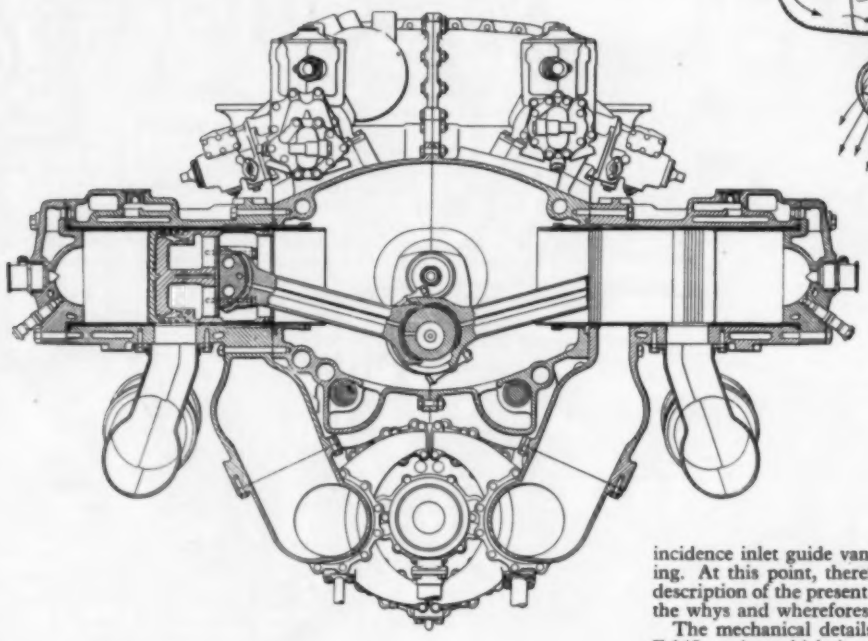


On the right is shown the variable-ratio gear in close-up, with an inset which emphasizes the avoidance of metal-to-metal contact.

2,000 lb/sq in was high for a commercial diesel engine, and demanded robust construction. Exhaust release—controlled by the uncovering of the cylinder ports by the piston—also took place at high pressure; for example, the full-throttle exhaust pressure was some 78 lb/sq in, indicating a drop in pressure of about 11 lb/sq in across the cylinder. No valve gear of any kind was used, but a simple ignition system was provided for starting purposes.

It was considered that the only method of meeting the opposing demands of maximum take-off and cruising efficiencies was to have an auxiliary turbine for use only in the former condition. Thus, the main power turbine was designed for efficient operation at a single point while passing the full gas flow, i.e., its choking line was reached approximately at maximum continuous power. For take-off, an additional power turbine was brought into operation by opening a flap valve; at the same time, the gear ratio of the centrifugal impeller was changed from S to M (the converse of what might have been expected) and, to preserve proper matching through all parts of the engine, additional fuel was injected into the diesel exhaust—there was plenty of oxygen there—for combustion in special cans which can be seen in the upper photograph on p. 544. (It is worth stressing that, even with this additional combustion, the Nomad turbines—unlike gas turbine rotors—are not required to operate at the limit of either stress or temperature, so that very long life should be possible.)





The cross-section (left) is made in the plane of the rear pair of cylinders, looking forward. In the bottom corners of the crankcase can be seen the two shafts connecting the rear and front gear trains. Above is a diagram of the Nomad gas flow, emphasizing the smooth path which has been achieved.

All the foregoing discussion refers to the original form of the Nomad, as illustrated and drawn on p. 544. Early Nomads were exhibited at Farnborough and, while undoubtedly impressive, were of such bulk and complexity as to receive very little firm interest from operators concerned with immediate requirements. There were many who thought that the Nomad would be inflexible and difficult to control and, in fact, would not make a really "usable" power plant except for a restricted range of applications. In 1951, brief details of the first engine were made public, and that year's S.B.A.C. flying display and exhibition saw Nomads on the Napier stand and airborne in the nose of a Lincoln test-bed. Starting the engine was soon found to be quite straightforward, and no trouble resulted from the fact that the two co-axial airscrews absorbed different powers. Altogether, this first Nomad (the Nomad 1, at NNm.3 rating) taught Napiers a very great deal.

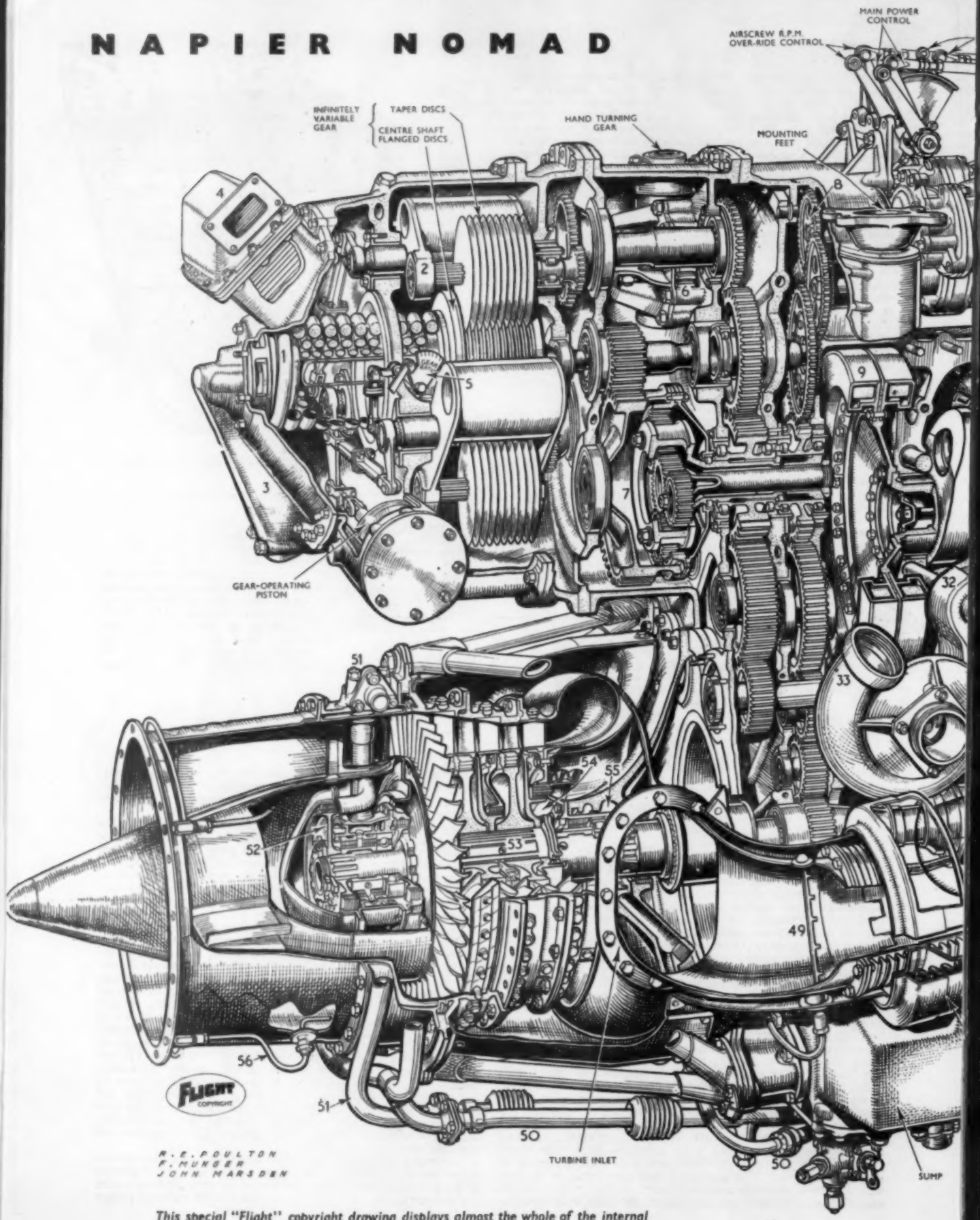
By 1951 the company had been able to "take a second look" at the engine and, so great had been the advances made in the preceding five years, it was very soon decided to re-design the whole unit. On the Naiad turboprop, for example, the company had done a great deal of work on axial compressors, and had eventually obtained pressure ratios exceeding 10:1 from single "spools," with very good flexibility and with peak efficiencies at least in the late 80s. The company's engineers began to see their way clear to an immense simplification of the engine, by doing *all* compression in the axial unit. In addition, the adoption of variable-incidence inlet guide vanes increased flexibility and ease of starting. At this point, therefore, it is appropriate to include a basic description of the present E.145 Nomad, before going on to discuss the whys and wherefores of its layout.

The mechanical details of the Nomad (from here on it is the E.145 engine which is referred to) are very well shown in the accompanying drawings. The two main parts of the engine are the reciprocating engine and the turbine-compressor set which is situated underneath. The reciprocating engine is a two-stroke diesel, with two horizontally-opposed banks of six valveless cylinders, each of 6in bore and 7½in stroke, giving a total swept volume of 41.1 litres.

The crankcase is cast in RZ-5 magnesium-zirconium alloy, and is split on the vertical centre-line to permit insertion of the continuous six-throw, nitrided-steel crankshaft. The two cylinder-blocks are castings in L.51 aluminium alloy, and contain liquid-cooling passages. Above the blocks are the two sets of injection pumps, which feed the injectors mounted centrally in the head of each cylinder. The axial compressor is hung from four flexible links beneath the crankcase, and its forward-facing intake is arranged to take full advantage of ram air from an intake immediately behind the airscrew spinner. There are 12 stages of blades, the maximum mass flow and pressure ratio being 13 lb/sec and 8½:1 respectively. The compressor is driven by a three-stage turbine, which is attached to the rear gear casing of the engine by a tubular framework. Both the turbine and compressor are mounted on shafts with internally-toothed couplings at the ends to accommodate thermal expansion; these shafts enable a positive drive to be effected between the turbine and the compressor and rear gear train.

The rear gear casing itself is, like the crankcase, a magnesium-zirconium alloy casting. In addition to housing the main portion of the gear drive between the turbine and the reciprocating engine it also contains the oil sump, the oil pressure and scavenge pumps

NAPIER NOMAD



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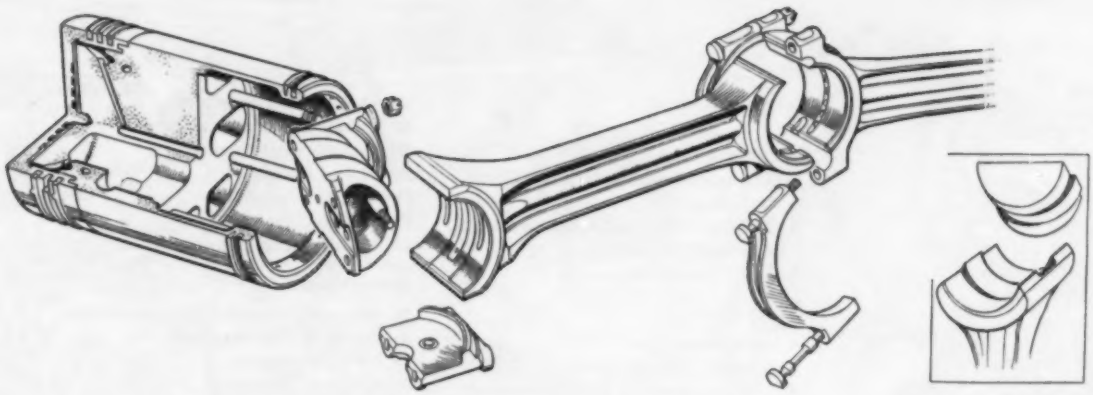

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It will be appreciated from the above that the Nomad now has a single airscrew shaft. Owing to the elimination of the airscrew formerly driven solely by the turbine, gearing has to be provided linking the turbine/compressor-set with the crankshaft. This is also rendered essential by the elimination of the original mechanically-driven centrifugal compressor, for under starting conditions no two-stroke engine is self-aspirating. At full power, the turbine provides all the power required to drive the axial compressor, together with an excess which is passed to the airscrew *via* the rear gear train.

In the Nomad 1 (of the early layout) the control system was such that the engines were run at constant boost, with a full-throttle height of 27,000ft. A single-lever boost control was arranged to speed up the axial turbo/compressor set as height was gained, this being done by making the boost-control influence the setting of the constant-speed unit of the front airscrew, which (in these original engines) was driven solely by the turbine. Accordingly, once the boost control had been set for climbing, the system would fine off the pitch of the airscrew and so speed up the axial compressor until the overspeed stop of the forward airscrew limited movement.

Thus, on the revised engine, it is essential to have a variable-ratio gear somewhere in the drive connecting the axial compressor and the crankshaft, to allow for high-altitude flight. If the two parts of the engine were rigidly geared together, the resulting Nomad would be a "full-throttle at sea level" engine, with a severely drooping power/altitude curve. The actual type of gear employed is that developed by Dr. Beier, an Austrian working in Germany, which was selected when all the other gears considered by Napiers—and there were many—failed to meet requirements.

The Beier gear, which has been used in bus and various industrial transmissions, is a pre-war development which is now finding a variety of applications. One of its advantages is that, whereas most infinitely-variable gears have no more than one or two points of contact, the Beier can have any number. The principle is as follows: a central splined shaft carries a "pack" of discs with narrow conical rims forced together by a large spring; between these rims are trapped a series of planetary discs carried on (in the case of the Nomad) three parallel shafts disposed at 120 deg intervals around the central shaft. The planetary discs are, as the drawings on p. 544 show, slightly coned so that their thickness decreases with increasing radius. Each planetary shaft swings about a fulcrum so that the distance between the planetary and central shafts can be varied. By arranging a gear on each planetary shaft in continuous mesh with another gear on the fulcrum of each planetary shaft, it is possible to swing the planetary discs in and out while running.

In operation, the gear is lubricated by high-pressure oil directed at the points of contact between each flanged and coned disc (see detail sketch); metal-to-metal contact is thereby prevented, the power being transmitted through the drag force produced by shearing the thin oil film. The slip factor is normally less than 1 per cent. In the Nomad there are ten central discs, all of E.N.31 ball-bearing steel; the planetary discs have included rim-angles of some 3 deg. Points of advantage of the gear are its conservative loading, the fact that it can be "stretched" by adding extra discs, the combined assets of low weight and bulk, and very good mechanical efficiency over the operating range. Contrary to what might be expected, there is very little heat generation and the discs show no visible wear after long endurance testing. In the Nomad, a simple expedient has made it possible to reduce the size of the variable-speed gear to its present value: the reduction gear between the turbo/compressor set and the crankshaft is of epicyclic form, and the gear is connected across two members of the epicyclic train. This has the effect of producing two mechanical systems in parallel, and only about 30 per cent of the total transmitted power has actually to be accommodated by the variable-speed gear.

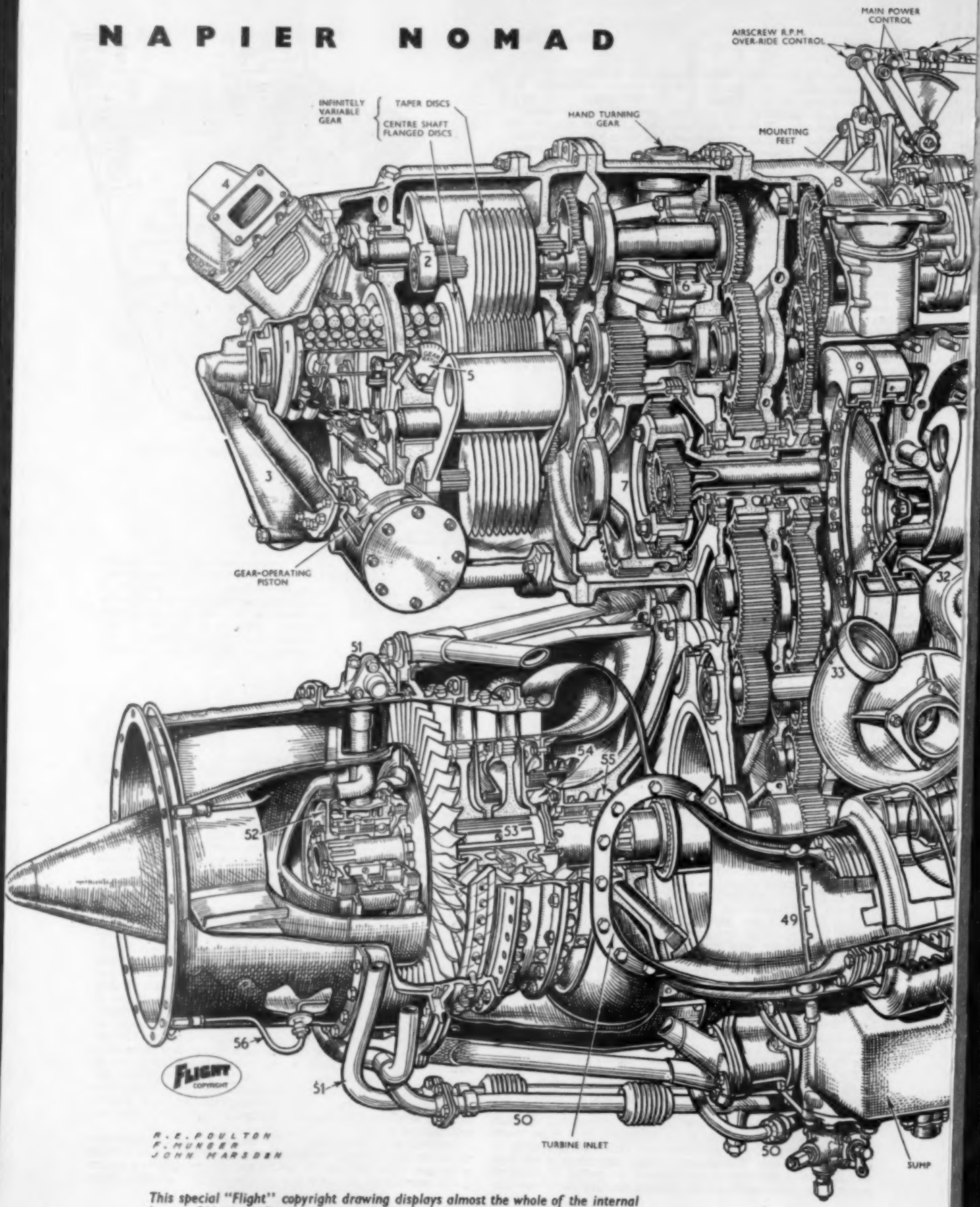
The insertion of this gear makes it possible to run the Nomad as though it were a unit with an infinite number of supercharger gear-ratios. The only factor really governing the "steps" in the movement of the variable-ratio box is the sensitivity of the boost control; a change in boost of less than $\frac{1}{4}$ lb/sq in brings about a response, so that the gear ratio is varied by literally thousands of tiny inching movements.

The actual method of control is as follows: the pilot has a single-lever r.p.m. control acting on the pitch of the airscrew. Having selected the appropriate r.p.m. the pilot is automatically presented with the correct boost pressure and fuel flow, below the rated height. As the aircraft climbs, the control system will respond after a very slight fall in boost, and will signal the selector valve to pass oil to the actuating piston of the variable-ratio gear, and so increase the mesh of the discs and speed up the axial compressor in order to maintain the boost pressure. When the compressor reaches its maximum permitted r.p.m., the engine is at the maximum-power altitude for the particular condition selected; above this altitude, the fuel flow is reduced automatically by a re-setting device in sympathy with falling boost pressure. The actual boost control itself is quite conventional, apart from the very high boost pressures involved.

Turning to the other mechanical details of the engine, it is at once apparent that the E.145 Nomad is not only simpler than the original engine but even more efficient thermodynamically. Throughout, the improved simplicity has made it possible to keep heat in the cycle so long as it can do useful work, and so long as the materials of the engine can stand the resulting temperatures. For example, whereas the E.125 Nomad had wet cylinder-liners, the E.145 has dry liners without any of the "plumbing" formerly needed; they also make possible an increase in cylinder capacity. The liners are actually a copper-chromium alloy ($\frac{1}{2}$ per cent cr) with an inner wall of dense chromium plate, lapped. The copper not only provides the high thermal conductivity needed, but also expands in sympathy with the light-alloy cylinder block. The chromium-plated bore likewise provides long life. The cooling of the block, restricted to the regions around the exhaust port, cylinder head and part of the liner, is simpler than the arrangement used in the original engine, and also reduces weight.

Admission and exhaust are highly efficient in the present engine. Whereas the early Nomad had all-round admission and a "mushroom" gas movement inside the cylinder, the hot, highly compressed intake air of the E.145 passes through a cascade of light-alloy deflectors and then enters through ports well down on one side of the cylinder (see detail sketch, p. 550). After moving up the wall of the cylinder the air traverses the hemispherical combustion space (into which it is forced by the ascending piston) and leaves *via* three ports in the other side of the cylinder as the

NAPIER NOMAD



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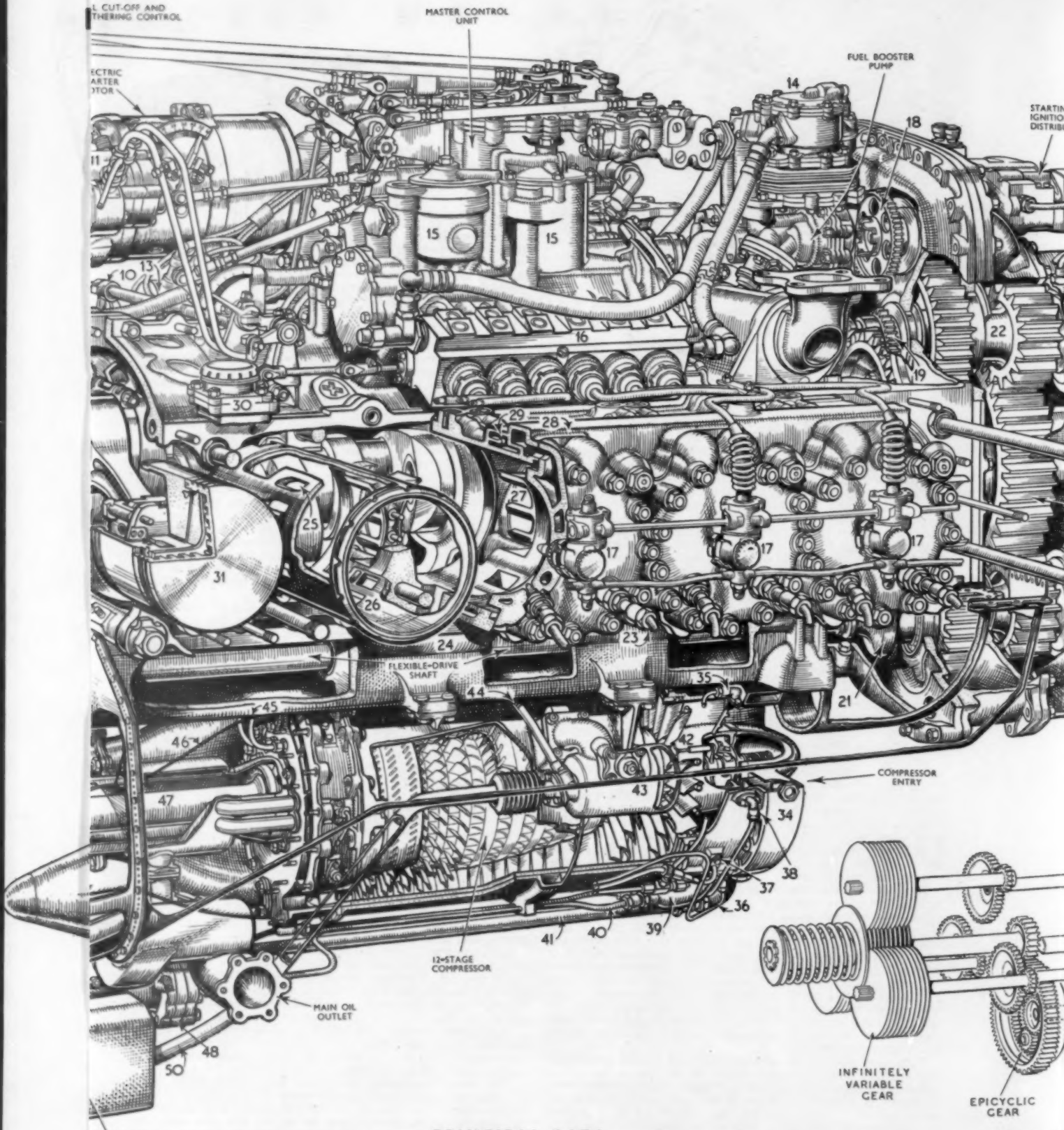
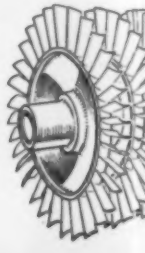


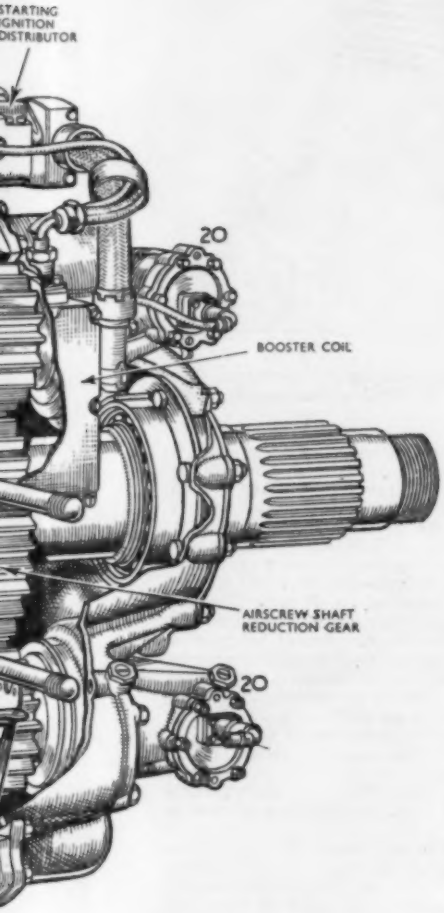
PRINCIPAL DATA

Twelve-cylinder, two-stroke valveless diesel engine compounded with three-stage turbine driving both crankshaft and axial compressor. Specified fuels: diesel pool gas oil, wide-cut petrol (D.Eng.R.D. 2486), or kerosine (D.Eng.R.D. 2482); lubricating oil to D.Eng.R.D. 2472B/2.

Overall height, 40in; overall width, 56½in; overall length, 119in; cylinder bore, 6in; stroke, 7½in; swept volume, 41.1 litres; axial compressor, 12 stages with mass flow of 13 lb/sec and pressure ratio of 8.25:1; cylinder compression ratio, 8:1; overall pressure ratio, 31.5:1; boost pressure, 89 lb/sq in absolute; brake mean effective pressure, 205 lb/sq in; overall expansion ratio, 24:1; airscrew reduction gear ratio, 0.526, 0.555, 0.569, 0.614 or 0.660 to 1; airscrew type, Rotol (solid light-alloy blades) or de Havilland (hollow-steel blades) in sizes from 13ft to 16ft diameter; dry weight 3,580 lb. Note: The performances given refer to full power at sea level.

The principal features of the Nomad's performance are given in the power and s.f.c. curves on page 551; actual points from these curves are: sea level take-off (crankshaft 2,050 r.p.m., turbine 18,200 r.p.m.), 3,046 s.h.p. at 0.355 lb/hr/s.h.p., or 3,135 e.h.p. (allowing for 320 lb thrust) at 0.345 lb/hr/e.h.p.; operational necessity at 11,000ft, in I.C.A.N. atmosphere at 300 knots T.A.S. (crankshaft 2,050 r.p.m., turbine 19,800 r.p.m.), 3,110 s.h.p. at 0.346 lb/hr/s.h.p. or 3,250 e.h.p. at 0.333 lb/hr/e.h.p.; cruising at 25,000ft under same conditions (crankshaft 1,750 r.p.m., turbine 19,600 r.p.m.), 1,952 s.h.p. at 0.340 lb/hr/s.h.p. or 2,024 e.h.p. at 0.327 lb/hr/e.h.p.





Variable Gear

1 Disc-loading spring.
2 Swinging shaft.
3 Oil-pressure feed gallery to centre-shaft discs.
4 Gearbox breather, with matrix separating oil from air.
5 Gear ratio indicator.

Wheelcase

6 Hand-turning gear.
7 Epicyclic reduction gear.
8 Turbine governor and tachometer drives.
9 Viscous crankshaft damper.

Top Cover

10 Fuel-rack cross shaft.
11 Turbine over-speed governor.
12 Turbine tachometer generator.
13 Crankshaft tachometer generator.

Fuel System

14 De-aerator.
15 Filters (4).
16 Injection pumps (2).
17 Injectors (12).

Front Casing

18 Booster-pump drive.
19 Injection-pump drive take-off.
20 Torquemeters.
21 Flexible-shaft front coupling.
22 Layshaft reduction gear.

Cylinder Block

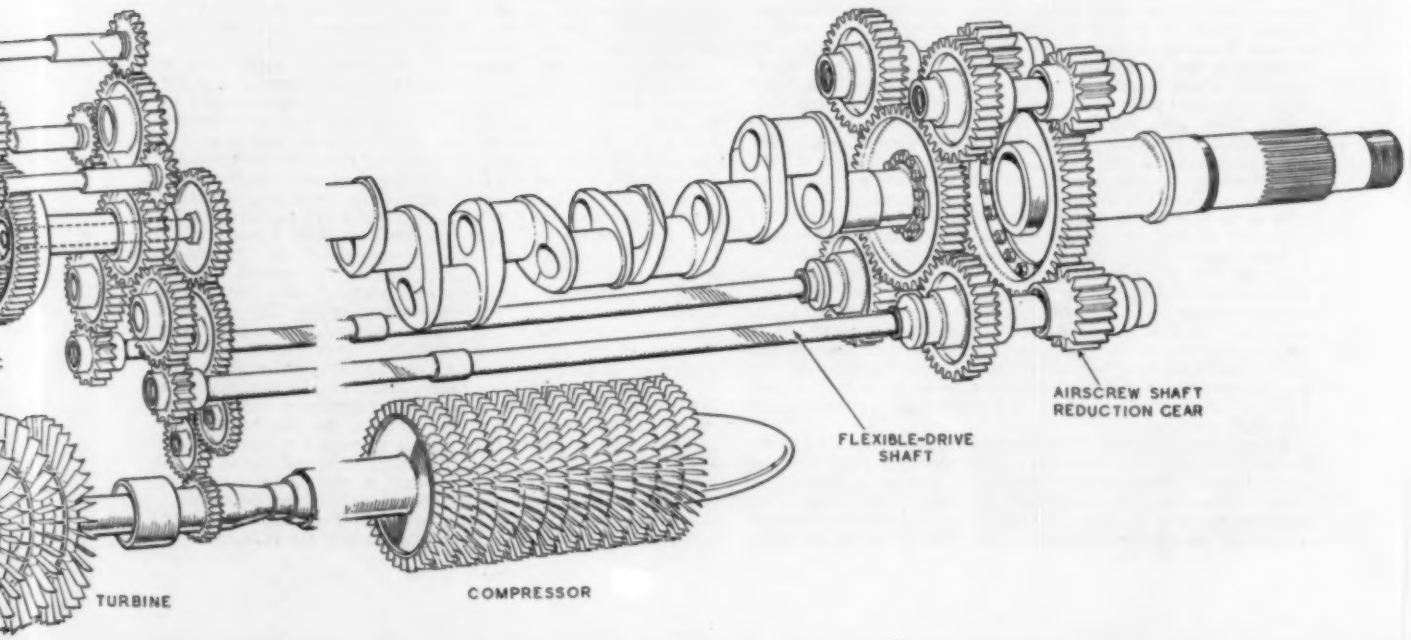
23 Igniter plugs.
24 Dry liner.
25 Induction ports.
26 Exhaust ports.
27 Induction-port deflectors.
28 Coolant distribution gallery.
29 Coolant return to outlet.
30 Coolant outlet.
31 Hot-crown piston.
32 Induction trunk.
33 Coolant pump, delivery to block.

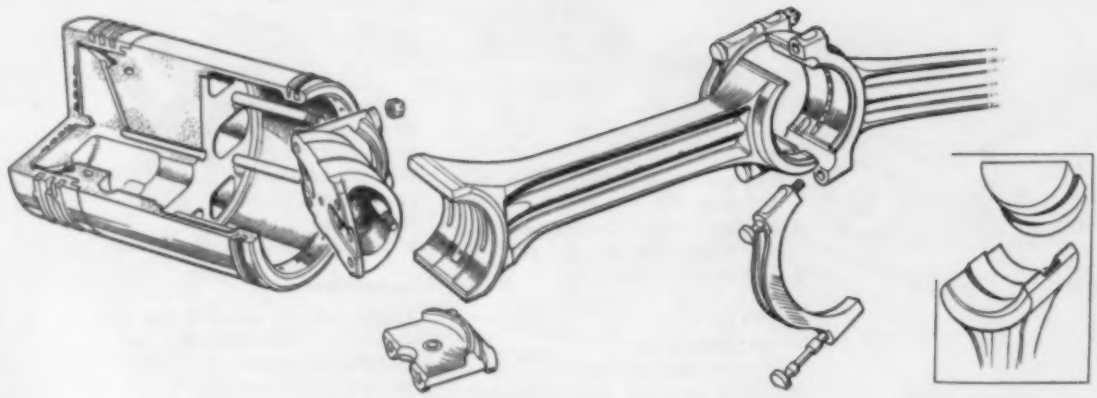
Compressor

34 Entry annulus, with struts and bullet de-iced by 12th-stage air.
35 Air pitot pressure.
36 Air static pressure.
37 Air temperature.
38 Oil to front bearing.
39 Sump.
40 Oil return to scavenge pump.
41 12th-stage supply to de-ice intake.
42 Variable-incidence intake vanes.
43 Filter of 4th-stage air to turbine and compressor bearings.
44 Air to cool compressor bearings.
45 Oil to rear bearing.
46 Bifurcated delivery trunk.
47 Coupling shaft to turbine.
48 Compressor-oil scavenge pump.

Turbine

49 Exhaust-pipe pressure.
50 4th-stage compressor air to front and rear bearings.
51 12th-stage air to thrust-balance piston.
52 Thrust-balance piston.
53 12th-stage disc-cooling air.
54 Labyrinth seal pressurized by 12th-stage air.
55 Circulation space for 4th-stage bearing-cooling air.
56 Tail-pipe pressure.





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NAPIER NOMAD . . .

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gap being initially ionized by a high-voltage, low-energy spark, after which follows the low-voltage discharge with really high energy. In conjunction with K.L.G. plugs, one of which is mounted beneath each injector, this system provides trouble-free starts, and appears to be completely unaffected by any condition of the plug points.

The installation of the Nomad cannot yet be fully discussed, for it is not yet completely developed. At present, two engines are being made up into power-plants for installation in an Avro Shackleton MR.1 flying test-bed, replacing the outboard Griffons. The engine is slung from four vibration-damping mountings carried by a pair of semi-cantilevered bearers which lie along the upper flanges of the crankcase, above the injection pumps. The cowling fits tightly, with small streamlined blisters covering the cylinder heads. Immediately behind and below the spinner is the main air intake. The coolant radiators can conveniently be placed in the wing adjacent to the nacelle, and it may be noted that radiator size is governed solely by the heat-release rate required by the diesel component at take-off and not by the power of the complete engine (for the turbine needs no cooling), which in practice is equivalent to a reduction of some 12 per cent.

Many readers will no doubt wish to be able to assess the advantages possessed by the Nomad in comparison with the Wright Turbo-Compound engine. The latter is, as we said in our "Aero Engines" number on April 9th, "a compounded R-3350 18-cylinder radial engine, with three small, single-stage, blow-down power-recovery turbines fitted on radial shafts spaced around the engine at 120 deg intervals. These turbines are spun by the exhaust gas whenever the engine is running and they are connected, *via* fluid couplings, to the crankshaft, to which they feed up to 600 h.p."

Thus, the basic unit of the Turbo-Compound is a highly-developed petrol engine operating, as do most high-power piston aero engines, up to the limits permitted by the onset of detonation. It is, therefore, essential that any turbine fitted in the exhaust system should impose the absolute minimum back-pressure on the cylinders, in order to avoid accentuating the already acute detonation problem and possible difficulty caused by such considerations as overheating of exhaust valves and reduction in volumetric efficiency. The Wright turbines are, therefore, of the blow-down type, in which the drive is effected by the impulsive velocities in the exhaust ducts. These velocities are continuously changing throughout each exhaust period and, moreover, are affected by r.p.m., boost and altitude. It is an inescapable consequence that the turbine efficiency is lower than that attainable with a relatively steady-pressure gas supply and is also far more variable with engine operating conditions.

In the Nomad, detonation problems do not exist, and the back-pressure imposed on the cylinders can be so chosen as to give the best overall operating conditions. As a result, not only is the turbine efficiency significantly higher than that of any blow-down unit, but it is also maintained over a very wide range of operating conditions. Thus, while the best specific fuel consumption of the Turbo-Compound is about 0.38 lb/hr/b.h.p., and is achieved only at the difficult-to-maintain optimum condition of speed, power and altitude, the Nomad can get down to about 0.327; and —as the performance curves show—it maintains figures below 0.35 over almost the entire practical range of conditions.

These performance curves do not indicate turbine/compressor r.p.m., which vary between 19,800 in the "operational necessity at altitude" case, through the following: full power at sea level, 2,050 crankshaft r.p.m. and 18,200 turbine r.p.m.; recommended cruise, 1,750/14,960 r.p.m. at sea level and 1,750/19,600 r.p.m. at altitude (the latter showing the variation in gear ratio required of the variable-speed gear, 14,960 r.p.m. maintaining 43 lb/sq in boost in the cylinder at sea level) and a flight idling turbine r.p.m. of 6,700, equivalent to 4 lb boost.

At present, as the data table shows, the weight/power ratio is about 1.17lb/h.p. Naturally, this is a poorer figure than can be achieved by a modern turboprop—but, quite apart from considerations of fuel consumption, the turboprop is still invariably a full-throttle engine, and the Nomad begins to look more competitive at altitudes above 20,000ft.

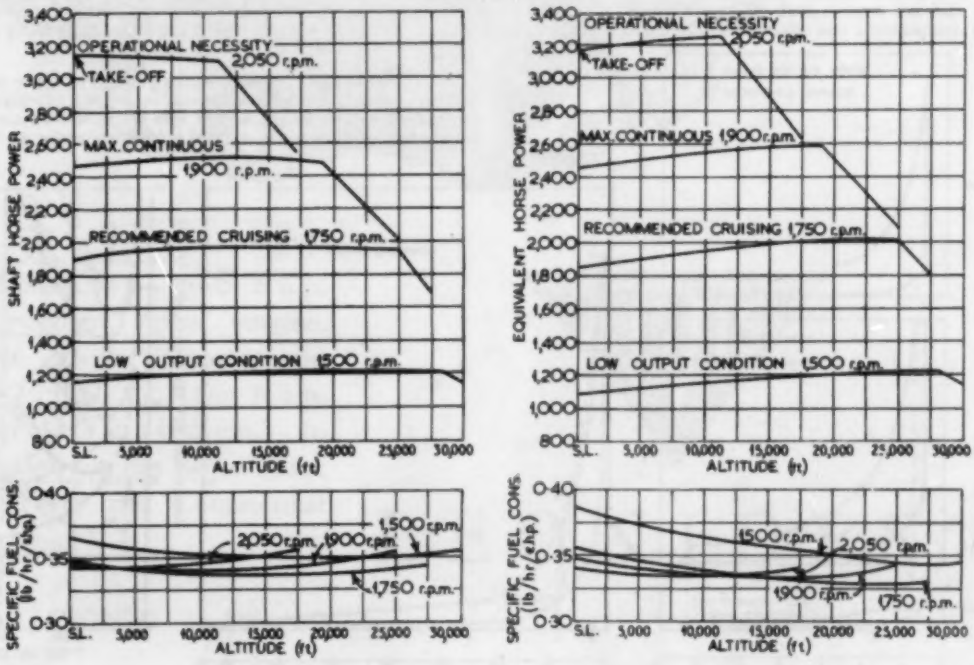
At present, development is in hand aimed at still further increasing the output of the basic Nomad, for very little increase in weight. With water injection into the intake manifold, powers of the order of 3,580 e.h.p. are available, representing 87.2 h.p. per litre and corresponding to a specific weight of 1 lb/h.p. Still further increases in power result from the combustion of a small quantity of additional fuel in the exhaust manifold between the cylinders and the turbine, there being sufficient excess oxygen available to make this well worth while. With combined water injection and "reheat" the take-off power can be increased to no less than 4,095 e.h.p., corresponding to values of 99.6 h.p. per litre and 0.93 lb/h.p.

Performance of this order, coupled with the Nomad's other advantages—such as its ability to burn not only diesel fuel, for which it was designed, but also wide-cut petrol, kerosine, and other fuels, and also its comparative insensitivity to temperature changes (it loses less than two per cent take-off power for each 10 deg C rise in ambient temperature) would seem to assure a wide acceptance of the engine in several fields. The next five years may, in fact, see this engine making reconnaissance patrols of unprecedented duration and, in commercial use, permitting freight and passenger fares far below the present I.A.T.A. standards. In fact, it is certain that no other engine can at present match the economy of the Nomad—nor, in all probability, will any engine, until such time as an atomic power unit is developed.

W.T.G.

[An important lecture on the Nomad, by Mr. E. E. Chatterton, chief engineer of the Napier piston-engine division, is summarised overleaf.]

These performance curves refer to the Nomad 2 (E.145) at the NNm.6 development stage. The left-hand graph shows shaft horse-power and s.f.c.in I.C.A.N. atmosphere at 300 knots T.A.S.; the right-hand figure shows equivalent horse-power under the same conditions.



NAPIER DIESELS: AN R.Ae.S. LECTURE

ON Thursday, April 22nd, the chief engineer of the Napier piston-engine division, Mr. E. E. Chatterton, B.Sc.(Eng.), M.I.Mech.E., F.R.Ae.S., read a paper entitled *Compound Diesel Engines for Aircraft*, before the Royal Aeronautical Society. The paper covered certain fields outside the scope of the description of the Nomad engine on the preceding nine pages and these parts of Mr. Chatterton's survey are summarized below.

The association of a gas turbine with a piston engine (said Mr. Chatterton) was by no means a new conception; a diagram showed the layout of a turbo-supercharged Napier Lion V of 30 years ago. Exhaust-driven blowers had later seen wide service in the 1939-45 war. But such installations were mere extensions to conventional power units, with limited objectives. The Nomad, on the other hand, was a combination of reciprocating and turbine power, both components being designed and matched from the inception. Here, the cycle of operations could be so manipulated as to exploit all the most valuable features of each component.

The lecturer then briefly examined the characteristics of the basic thermodynamic cycles. The spark-ignition engine consumed essentially all the air supplied to it, and power largely depended upon the rate at which air could be inhaled and rejected. The indicator diagram [below] showed that combustion took place at constant volume, the peak temperature being some 2,500 deg C. Thermal efficiency was basically governed by the ratio V/v, which was limited by the onset of detonation. Only by the development of very special fuels, charge-cooling and water injection had the spectacular power increases of the late war been made possible.

The compression-ignition engine, on the other hand, was generally unable to utilize more than about 80 per cent of the air trapped in the combustion chamber, owing to the fact that all the fuel-mixing had to be completed within a crank angle of 35 to 40 deg. The two-stroke diesel also lost air through the necessity for scavenging after each power stroke. The indicator diagram [below] showed that combustion took place partly at constant pressure and partly at constant volume, the amount of the latter being limited by the permissible cylinder pressure. As the ratio V/v was high, thermal efficiency was good, with consequent improvement in fuel consumption. No detonation could take place, so that, provided sufficient back-pressure were offered at the exhaust ports, any reasonable degree of supercharge could be accepted.

The gas turbine (shaft-drive) employed constant-pressure combustion, and volumetric expansion ratios were at present lower than those obtainable in reciprocating engines, with correspondingly poor thermal efficiency. The maximum combustion temperature of 2,500 deg C was too high for turbine inlet conditions, so that air, to the extent of some 3½ times that of the amount needed for combustion, had to be provided to cool the flow to some 1,100 deg K. But a turbine driven by piston-engine exhaust did not require such an excess of air, for the reduction in gas temperature was achieved by doing work in the cylinders.

The compound cycle of the Nomad [also shown below] was formed from two individual PV curves, the line ABC indicating the division of work between the piston engine and turbine; the pressure-drop AB was that which existed between the exhaust port and the turbine inlet. Compression in both the axial unit and the cylinder, and expansion across the turbine right down to atmospheric pressure, made possible the attainment of very high overall ratios. These ratios were not materially affected by the position of the line ABC, but the division of work did have a great effect on the dimensions and weight of the whole engine.

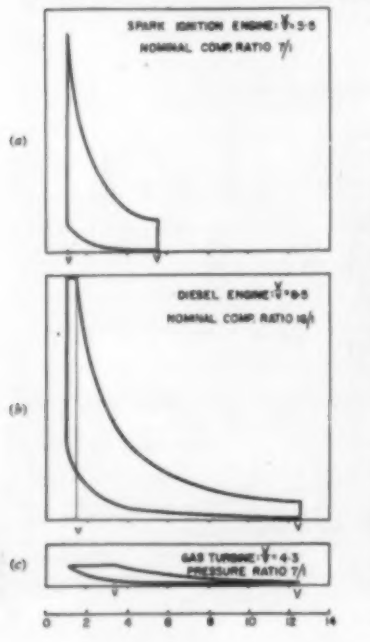
The designer was initially presented with fixed maxima for cylinder pressure and turbine inlet temperature. If the diesel burnt *all* its air the temperature at P would be about 2,500 deg C, and point C would be fixed by turbine-inlet temperature considerations—which would in turn establish supercharger pressure.

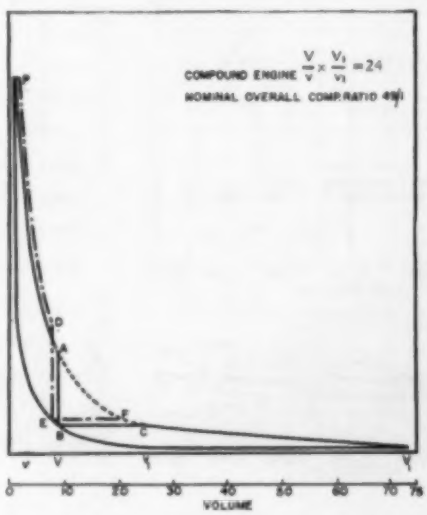
But, by controlling fuel supply and port design, a large flow of excess air could be put through the diesel component, which would mix with, and cool, the exhaust, so that the turbine inlet point could be raised from C to F, on a new "division of work" line DEF. By so doing, the supercharger pressure would be raised, so that more air would be supplied, more fuel burnt, and a greater mean indicated pressure be developed, as shown by the dotted expansion line.

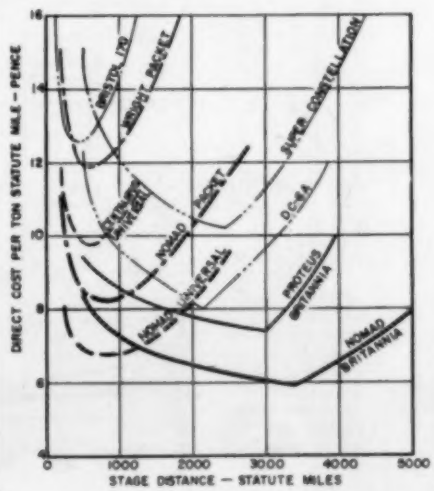
This adjustment was limited by cylinder thermal loading but, owing to the excess airflow, cooling was most effective; heat lost to the air was subsequently recovered in the turbine and therefore retained in the cycle. Exploitation of this factor made possible a rate of fuel burning much greater than usual for diesel engines, with a corresponding reduction in engine size and weight for a given power.

The lecturer then went on to discuss the various ways in which a two-stroke diesel, a gas turbine and a compressor might be compounded. First, the compressor could be driven by the turbine, all the power being delivered to the piston engine; secondly, the compressor could be driven by the piston engine, all output power being taken by the turbine; and, thirdly, all three components could be coupled together to form a common mechanical system. This last was the basic mechanical system employed in the Nomad.

After giving a detailed description of the Nomad itself, Mr. Chatterton went on to assess its place in aviation. Applications of particular promise, he said, appeared to be ocean reconnaissance, military close-support transport and civil freighting. In the first rôle, the ability of the Nomad to offer unrivalled economy with any desired flight plan—at low level if required—was an advantage, while the large fuselage openings of the assault transport tended to rule out pressurization. Regarding freight aircraft generally, the lecturer showed cost curves for a number of such machines [reproduced below] with calculated values for Nomad power. The three most important machines at present used the following fuels: Britannia (Proteus, Avtur at 1/10d per gal), Universal (Centaurus, 100/130 grade petrol at 2/7½d per gal), and C-119G or H Packet (Turbo Compound, 115/145 grade at 2/9d per gal). With the Nomad, all could use diesel fuel at 1/8d.







The three PV indicator diagrams on the extreme left refer (as indicated) to a spark-ignition engine, a compression-ignition engine and a turboprop. In the centre is the corresponding curve for the Nomad. On the right are c.t.m. curves for a number of transport aircraft, based on a 3,000 hr/year utilization at 100 per cent load factor.

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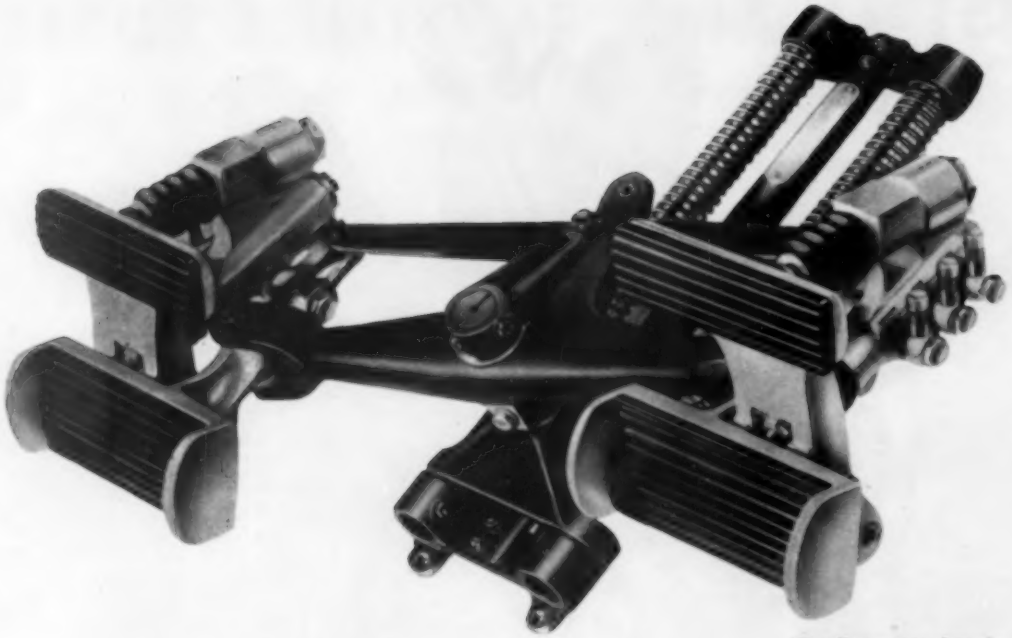

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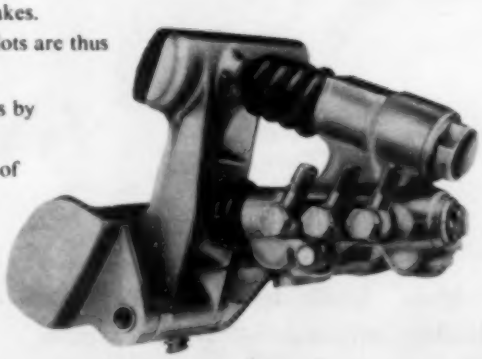

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CANADIANS FORM NEW AERONAUTICAL BODY

A Dominion Counterpart of the R.Ae.S.: Toronto Inaugural Lecture on Water-ski Craft by E. G. Stout

The C.A.I. interim committee sign their Dominion charter application. Left to right: (Back row) T. E. Stephenson, Aircraft Deputy Director, Department of Defence Production (official witness); G. E. Rosenthal, aerodynamics section, Canadair; H. C. Ostway, Defence Research Board; R. H. Guthrie, executive engineer, Canadian Pratt and Whitney. (Centre row) R. D. Richmond, chief development engineer, Canadair; I. M. Homer, technical director, Dowty Equipment of Canada; G/C. C. W. Crossland, A.F.H.Q.; H. A. Rass, president, Ross Aero. (Seated) H. C. Luttman, patents officer and contracts supervisor, A. V. Roe Canada; G/C. H. R. Foottit, Director of Development "A," A.F.H.Q.; Dr. J. J. Green, Scientific Adviser to the Chief of the Air Staff. Not shown is J. Lukasiewicz, Head, High Speed Aerodynamics Laboratory, N.A.E.

THE proposed formation of a national society in Canada "to advance the art, science and engineering related to aeronautics" has been discussed at length over the past few years. Such a society, with functions corresponding closely to those of the Royal Aeronautical Society, finally came into being on February 6th of this year, when a charter application for the Canadian Aeronautical Institute was forwarded to the Canadian Secretary of State.

According to G/C. H. R. Foottit, chairman of the Institute's interim council, the initial steps consisted of discussions with the Royal Aeronautical Society, the Institute of the Aeronautical Sciences, and the Engineering Institute of Canada. After the need for a new national society had been established by means of a referendum, the interim council was formed. On this council were executive members of the four existing Canadian aeronautical organizations (the Montreal Institute of Aircraft Technicians, the Ottawa Aeronautical Society, and the Toronto and Montreal branches of the I.A.S.) and two Canadian representatives of the R.Ae.S. "The Canadian Aeronautical Institute" was adopted as the name of the society.

The interim council decided that the objects of the Institute could best be implemented by encouraging the exchange of information between members, the presentation and discussion of technical papers, and the exchange of information between the C.A.I. and the R.Ae.S., I.A.S. and E.I.C. The publication of a journal, also, is among other means at present being studied. Much assistance and advice has been given by the Royal Aeronautical Society and the American Institute of Aeronautical Sciences, and support has come also from the Engineering Institute of Canada. The Air Industries and Transport Association, the Canadian organization representing aircraft manufacturers and airline operators, has provided office space and secretarial help for the C.A.I. at its headquarters at 108½, Sparks Street, Ottawa 4, Ontario.

Branches of the Institute have been formed at Ottawa, Montreal and Toronto, and other branches will be formed as the need arises. At the first annual general meeting at Ottawa on May 25th, two representatives from each of the three branches will be elected to form the council of the Institute, replacing the interim council and remaining in office for one year. Potential membership of the Institute is estimated to be initially 800.

Toronto Branch Inauguration

From Toronto, the Editor of *Flight* has sent the following summary of a lecture given by Mr. E. G. Stout, A.F.I.A.S. (staff engineer, Consolidated Vultee Aircraft Corporation) on the occasion of the inauguration of the Toronto branch of the Canadian Aeronautical Institute. This inaugural paper was read on April 7th at Toronto University.

Briefly tracing flying-boat designs from those of Curtiss in 1911, the lecturer referred to the little change which had taken place in hull design between the wars. He then described in detail the dynamically similar models which had played a vital part in his company's development work, giving credit for this idea and much of the early work to Britain. Mr. Stout next spoke of the development of the R3Y., blended hulls were part of the attempt to remove the speed handicap of conventional seaplanes. These efforts had been most successful. This led on to a discussion of water skis and in particular the Convair Sea Dart, which was the culmination of a policy adopted in 1938 of trying to eliminate the need for long runways.

The Sea Dart, the lecturer stated, was not designed as a seaplane in the accepted sense; the aim was for a "panto-based" machine (a night fighter in the original specification) which could be treated in the same manner as a land-based fighter. The aircraft could taxi in and out of the water on its wheels at speeds up to 15 kt. No clearing of the take-off path was required, because floating obstructions were deflected due to the high planing pressure of the skis. Other advantages were that no special handling crews or buoys were required, the machine being fully serviced on land, and simply taxying down the beach or ramp into the sea for take-off.

The speed at which the Sea Dart began to plane was about 10 kt, and it rose on to the hump at 35 to 40 kt (i.e., at the point of maximum water resistance). As the centre of gravity lay behind the skis, the machine assumed its own natural attitude during the take-off run, a stable tripod being formed by the two main skis and the tail ski. Lateral stability and a flat wake was provided by the wing trailing edge.

The specification had called for a machine able to cope with open seas and rough water. The main skis (which numbered two at this stage for stability reasons) were ball-mounted in front and incorporated large oleo legs with a 24in movement at the back. The tail ski had air brakes which, when used differentially on the water, gave a rudder effect for a 75ft turning radius.

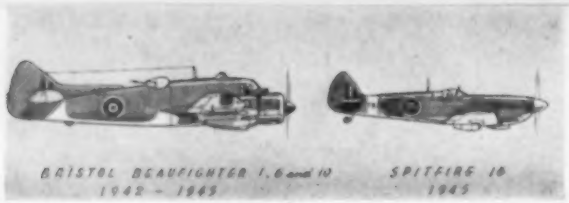
The basis of the Sea Dart structure was the steel centre-line keel. The wing was continuous through the fuselage and formed a platform on which the engines were lodged. The normal nose-up ground angle was 17 deg, take-off run about 5,500ft, and landing run 1,000ft. The aircraft was designed to alight not only on water, but also on snow, ice or sand—in fact, on anything except a concrete runway. Wet and slippery surfaces, such as grass swamps, were suitable, the worst surfaces being those of a hard, abrasive nature. There had been no thought of fitting conventional wheels to the machine (which at present incorporated fixed, solid wheels), but the next aircraft would have retracting pneumatic wheels for taxying, and would manœuvre on the ground in the normal fashion.

Among other details of the Sea Dart given by the lecturer was the fact that production aircraft were to have an alternative form of main air intake, designed to avoid water when taxying in very rough sea conditions. In the present version, the acceleration was already such that the aircraft lifted well up on to its skis in one aircraft length, in which position there was then no water on the windscreen or air intakes, and the pilot's view was good. The Sea Dart was fully buoyant in case of a forced landing in open sea, but normally it would not "float about" in water, but would taxi straight in or out. Landings and take-offs were made, as on delta landplanes, at a high angle of attack, and handling qualities both in the air and on the water were quite docile.

THE MORANE SAULNIER FLEURET

FRANCE'S side-by-side two-seat light jet trainer, the Morane Saulnier Fleuret, is at present engaged on a demonstration tour in the Far East, whence it is due to return in the summer.

Before the machine set out (and—we would add, in fairness to the makers—before the Editor's reference to it in the issue of April 2nd) the profile and contour of the air intakes were slightly modified to alter the spin characteristics, which were previously considered too docile for a trainer. In consequence, the aircraft now requires to be held in the spin by rudder and neutral or tail-down elevator; recovery by centralizing the controls, or by normal recovery action, is simple and effective. Test pilots report that the Fleuret is easy to fly and inherently stable at all air speeds.



THE QUEEN'S SQUADRON

A History of No. 603 (City of Edinburgh) Squadron, Royal Auxiliary Air Force

By JOHN YOXALL *Part II*

THE first part of this history, published last week, told the story of No. 603 squadron's early life after its formation in 1925; of its duties and relaxations in the years leading up to the war; of its part in the Battle of Britain; and of its move to assist the defence of Malta in the early summer of 1942. On August 3rd of that year the pilots were posted to No. 299 Squadron, which was then being formed at Takali, one of Malta's airfields; No. 603's ground staff had meanwhile moved to Egypt. The present instalment deals with the Mediterranean operations in which No. 603 Squadron was next engaged. The third and final part of this history will describe the unit's operations against the retreating enemy in Western Europe and, finally, its post-war existence.

FOR the ground staff there followed a long period of frustration. Plans were made to move to Burg-el-Arab to assist the Maryland Repair Unit, but the enemy advance to El Alamein upset this arrangement and the unit was taken by sea to Cyprus. During July the squadron had no aircraft and time was spent in servicing machines visiting Nicosia, and in assisting, as relief crews, No. 451 Squadron R.A.A.F. at Lakatamia. A detachment went to Paphos to keep the airfield serviceable. In August came the task of servicing the Packard-built Rolls-Royce Merlins in the Curtiss P-40s of the 65th U.S.A.A.F. Pursuit Squadron. S/L. Marshall came to take over command of No. 603 from S/L. Illingworth, who had remained in Egypt on the sick list.

The Americans left Cyprus early in September and 603 went back to the dreary round of waiting. This tiresome period finished at long last in December, when the unit was shipped back to Egypt and told that it would be equipped with Beaufighters, coming under No. 201 Group as a naval co-operation squadron. S/L. Marshall handed over the reins to S/L. H. A. Chater; and at Edku, on February 1st, 1943, the squadron became an operational unit once more.

Pilots and observers began to arrive, a number of them from No. 272 Squadron; S/L. Laycock, "B" Flight Commander, came direct from Britain. A detachment of four Beaufighters, led by S/L. Chater, went up to Berka (Benghazi) and the first "ops" to be flown for nearly a year took the form of close-escort patrol over a convoy. There is a popular idea that North Africa continually basks in brilliant sunshine; this is not so, and during the whole of February the squadron was dogged by bad weather. On a number of days the airfield was unserviceable.

By the beginning of March re-equipping was finished and most of the pilots had been converted to the Beaufighter. The A.O.C.-in-C. Middle East, Sir W. Sholto-Douglas (now Marshal of the Royal Air Force Lord Douglas of Kirtleside) came to visit the squadron, accompanied by Prince Bernhard of the Netherlands.

The twelve days from March 16th to 27th were spent in travelling from Edku up to Misurata West *via* Mersa Matruh, Buq Buq, El Adem, Maturba, Barce, El Agheila and Sirté. Despite the move, protection was provided for four naval convoys by the squadron Beaufighters stationed at El Magrum.

There was little interference from the enemy, but on the occasions when they put in an appearance the convoys became a trifle trigger-happy. There was one such occurrence on March 15th, when F/L. Ashby's Beaufighter, EL 448, was vectored on to some "Bogies." He sighted six or seven aircraft, possibly Ju 88s, about eight miles astern of the convoy. He lost them in the dark and returned to the ships, which immediately started firing on him. After making several more attempts to rejoin the convoy, each being defeated by flak, he flew back to Misurata.

Despite the pre-occupations of war, the 25th anniversary of the formation of the Royal Air Force was celebrated on April 1st, 1943. A parade of the whole squadron was addressed by A.V-M. T. A. Langford-Sainsbury who was then A.O.C. No. 201 Group. The only warlike activity for the day was the assignment of two Beaufighters to give cover to convoy "Rival." This patrol passed off without incident.

The same might be said of all the convoy patrols flown during April. The only excitement was on the 19th, when Beaufighter "J," while giving cover to convoy "Merit," had engine trouble and ditched 15 miles out to sea. The crew, unhurt, were picked up in their dinghies two hours later. In May, also, there were few incidents, though on the 2nd Beaufighter "E" failed to return from extra last-light cover to convoy "Liquid." Enemy aircraft were in the vicinity and, although two more Beaufighters were about, neither saw what happened to "E."

June was entirely quiet so far as the enemy was concerned. The high spot of the month was the cover given to convoy "Ferguson," which included the cruiser H.M.S. *Aurora* carrying King George VI on his return from Malta, G.C., to Tripoli.

At the end of the first week of July came the invasion of Sicily and No. 603 joined with Nos. 252, 272 and 227 in covering the convoys meeting south-east of Malta in readiness for the main assault. Lockheed Lightnings of the 96th Group, U.S.A.A.F., also participated; still, however, there was no response from the enemy air forces. On the 12th the squadron flew 19 sorties to give dawn-to-dusk fighter protection to convoy "Bowery," conveying supplies to the beachhead, but still no interference came from the enemy. Beaufighter "M" (Sgts. Downing and Gresswell) on this day burst a tyre on take-off but carried out the patrol before making a successful wheels-up landing. While on patrol "M" saw the air/sea rescue Wellington itself ditch; the survivors were picked up by convoy escort craft.

This absence of fighting in the middle of a war could not go on, and low-level bombing training came to be the order of the day. On August 14th, 1943 the C.O., W/C. Chater, left Misurata

Cause and effect: Sgts. Pete Penny (pilot) and Jeff Hyde (observer), and a Ju 52 which they had shot down, photographed as it hit the water; a few seconds later it burst into flame and the crew were seen swimming from the wreck.

From north of the Border: The strictly Scottish element of the squadron—photograph taken at Gambut in 1943-44.

with six aircraft for Berka III on detachment, and the next day they carried out an offensive patrol in the Peloponnese area. Bombs were dropped on a landing ground at Kalamata and in the adjacent harbour. Next day S/L. Atkinson led four aircraft to attack shipping in the harbour at Missolonghi in Western Greece.

These offensive patrols were flown each day from Berka until the end of the month, when preparations were made for a move to Borizzo in Italy. On the 3rd and 4th six Dakotas moved personnel and equipment; and all serviceable aircraft, numbering 14, were flown to the new station. The squadron formed part of No. 325 Wing, No. 242 Group, N.A.C.A.F., coming under 62nd Fighter Wing U.S.A.A.F. for operations. Despite the promise of busier days, the first three weeks were spent on entirely negative convoy patrols; but on September 24th the squadron got its first "enemy aircraft destroyed" after being equipped with Beaufighters. A section of four took off on a sweep in search of enemy transport machines evacuating Corsica. One Beaufighter returned with electrical trouble, but the others (W/C. Chater, P/O. Megone and W/C. Doube) sighted six Ju 52s, and each shot one down in flames; the wing commander also damaged another.

Though transport Ju 52s were considered easy meat, each of the Beaufighters was damaged by return fire. Megone, with his port inner fuel-tank on fire, made for the nearest land, Pianosa Island. On a quick decision he made a wheel landing in his still blazing aircraft on a flat strip of ground and was eventually able to put out the fire. The Italian population proved friendly and explained that the Germans were in the habit of visiting the island from Elba every evening. Megone and his observer, P/O. Williams, accordingly decided to chance taking off again. They did so successfully, and just managed to make base. For this exploit Megone received the immediate award of the D.F.C. There were no more brushes with the enemy during September, and preparations were made for another move, this time to Landing Ground 91 in Egypt, near Alexandria.

On January 27th, 1944: A Mediterranean battle scene after the Beaufighters of No. 603 Squadron had met five Arado 196 escorting two Junkers Ju 52s loaded with petrol. The Junkers were also destroyed.

Except for a convoy incident on October 7th, when one of the Beaufighters was jumped by two Me 109s and lost, most of the flying for the next three weeks was spent in ferrying. All the Mark 6 and Mark 11 Beaufighters were handed over to Nos. 227 and 252 Squadrons in exchange for Mark 10s. Then followed a series of offensive escorts to B-25s engaged on shipping strikes, mostly in the Kos area. In one raid, on Antimachia, the Beaufighters destroyed a Ju 52 which had just landed, hit some troops that had disembarked from it and further attacked parked aircraft — including some Spitfires!

W/C. J. R. H. Lewis, D.F.C., a C.O. of the "Med" period.

The unit was now operating from Gambut; but not for long was it allowed to remain as a complete squadron. On November 1st five aircraft flew to El Adem, from which station it was decided the squadron should operate pending the completion of the runways at Gambut. From here roving attacks were made on targets—mostly shipping—in the Aegean Sea. Intense flak was experienced over these targets and occasionally enemy fighters put in an appearance.

A typical sortie was one which took place on November 11th. Four 603 aircraft, in company with four torpedo Beaufighters of No. 47 Squadron, attacked barges and caiques at Port Naussa. Two barges were set on fire and one of three Arado 196s which tried to interfere was damaged. Beaufighter "Y" (P/O. Hopkins) shot down another Arado but was forced to ditch also. F/Sgt. Truesdale was wounded and had to crash-land on arrival back at base. P/O. Hopkins and his observer, W/O. Roget, were subsequently picked up by submarine and landed at Malta, returning to the squadron a week later. Two days later, in a similar affray, F/Sgt. Coulstock, navigator in "H," shot down an Arado with his V.G.O.*

The work the squadron was doing obviously stung the enemy badly, for they began to employ larger and larger air escorts, which they could ill afford. On November 16th, for instance, a Siebel ferry and two small barges bound for Leros had no fewer than seven Arado 196, four Ju 88 and four Me 109s to look after them. Even so, the ferry was sunk in a matter of minutes.

Meanwhile, the Beaufighters had been fitted with rocket rails, and the last week or so of November, and the first half of December, were spent in training to use the projectiles. On December 15th, the first R.P. sorties by a Middle East squadron were made, but no targets were sighted. Each day sorties were flown, but no targets suitable for the new weapons were found. It was, in fact, December 22nd before the first opportunity came. On this day four pilots attacked caiques at Amorgos and Mykonos in the eastern and central Aegean respectively. They were F/O. Smith (Beaufighter "N") and Sgt. Gow ("Q"), each carrying 60 lb R.P.s; F/O. Wilson ("P"), with 25 lb R.P.; and F/L. Partridge, with cannon only. The first caique, one of

* *Vickers gas-operated: the Beaufighter's rear gun.*

Officers of the squadron at Gambut in 1944: The known names are: (Back row) F/O. Woodier, ——, F/O. Hawkins, ——, F/O. Jenkinson and P/O. Sykes. (Centre) F/L. Lowe, ——, ——, ——, F/L. Heide, ——, F/O. Scott. (Front) F/L. Rogers, F/L. Oddy (Adjutant), S/L. Pain, W/C. Foxley-Norris, S/L. Deck, ——, ——.

W/O. Prentice says farewell to No. 603 when all airmen over 50 years of age were sent home from the Middle East; he was nearly 60. On the left is W/C. Foxley-Norris; W/O. Prentice shakes hands with F/L. Oddy.

THE QUEEN'S SQUADRON . . .

70-100 tons, was hit by both 25 lb and 60 lb R.P.s and left sinking. The second, a larger, three-masted, ship of about 150-200 tons at Mykonos, received one direct hit with a 25 lb R.P. and numerous cannon hits. It was left with only one mast standing and in a badly damaged condition.

Despite the fact that the squadron was under canvas in the Western Desert, Christmas 1943 was voted the best ever. Reconnaissance aircraft reported no sightings and no operations developed. In the traditional style, turkey and plum pudding were served to the airmen by the officers and senior N.C.O.s. Beer having been conserved for some weeks beforehand, there was even a generous supply.

Respite was short. On the next day nine Beaufighters went to Stampalia, where two caiques were sunk and the jetty blown up.

At the opening of the new year, 1944, weather hampered operations a good deal; convoy patrols were flown, but very little offensive flying took place. There was a slight change in tactics, in that the Beaus now operated in pairs.

On January 16th, two pairs were despatched to attack vessels seen in Khios harbour. Here the height of the buildings surrounding the harbour made it almost impossible to hit the vessels, but one was seen to blow up. Beaufighter "N," F/L. MacDonnell, was damaged when flying through debris thrown up from roof-top hits and had to ditch near Panaghia Island. When last seen, the navigator, F/O. Piner, was in his dinghy and the pilot was swimming nearby.

The sinking of caiques became an everyday occurence, the rocket projectile being an excellent weapon for the job. Occasionally an Arado 196 was sighted; but, generally speaking, very few enemy aircraft were encountered, either transports or fighters. On January 27th, however, a formation of three Junkers 52 floatplanes, accompanied by an equal number of Arado 196s, were sighted to the west of Mykonos. Four 603 Squadron Beaufighters attacked and in the fight all the Junkers were shot down, as well as two of the Arados.

The rocket projectile of those days was not entirely reliable, as F/O. Smith found during a sweep over the central Aegean. While attacking a 70-ton caique he had both wings of his Beaufighter badly damaged by premature bursts. On one side a rocket exploded immediately after launching, while on the other there was a detonation the instant Smith pressed the firing button. Despite the damage he was able to fly back to base.

In March, night intruding became an added duty—mostly over Crete—and the commanding officer took to leading formations of six or more aircraft on long anti-shipping sweeps. On almost every occasion at least one ship was either sunk or badly damaged; but the most profitable day was March 19th, when five ships totalling 680 tons were either sunk or badly damaged in 37 individual attacks.

In no way celebrating the anniversary of the establishment of the R.A.F. on April 1st, 1918, a firework display took place on All Fools Day in 1944; it was provided by red distress signals ignited by a fire which started in "A" Flight armoury tent. One of them totally destroyed the canvas orderly-room.

Air attacks on the enemy's shipping had by this time (April 1944) become so serious that he was forced to use more northerly routes. To bring these within range, overload tanks giving a duration of eight hours were requested.

The squadron was at the top of its form, taking on anything from anti-submarine attacks to night intruding; but at shipping strikes it excelled. Not a day or night went by without some addition to the scoreboard. A typical incident, or series of incidents, occurred on the night of May 8th, when F/L. Pringle, D.F.C., was on shipping search in the south-western Cyclades. First, north of Syros, he found a convoy of one Surose lighter, one E.M.S. craft and six auxiliary caiques. With cannon he attacked and sank the E.M.S., causing a violent explosion. Next a caique was set on fire and sunk, and another badly damaged.

After calling other Beaus to the scene Pringle continued his patrol. Six miles north-west of Serephos he located another convoy, this time consisting of one large vessel and three torpedo boats; all were taking evasive action to reach the shelter of the coast. As a result of his attack the tail torpedo-boat was hit.

Meanwhile a Canadian pilot, F/O. Soderland, reached the first-located convoy and attacked the Surose lighter with 60 lb R.P. A violent explosion resulted and all flak from the vessel ceased.

The night's work was described in a congratulatory message from Air H.Q. Eastern Mediterranean as "an outstanding example of precision in attack and co-operation." This was a fitting end to W/C. Lewis's command of the squadron. He had then finished his extension to his second tour. W/C. J. D. T. Revell came from H.Q. Middle East to take over. He first went to Shallufa to take an R.P. course, actually taking over the squadron on June 15th. The remainder of May was a dull period. Sandstorms held up flying, and days were spent in standing by for a big shipping strike.

It eventually took place on June 1st (1944) and proved to be an exceptional operation, no fewer than 71 aircraft being involved in the attack against three ships of 1,500-2,000 tons, each flying balloons and protected by eight escort vessels. No. 603 Squadron supplied eight Beaufighters which formed the starboard anti-flak escort to the main R.P. strike force. In the action two of the ships were severely damaged (one very probably sunk), three escort vessels damaged, one each Arado 196 and Me 109 destroyed, one Arado claimed as a probable and two further Arados damaged. No. 603 squadron's share was two escort vessels damaged for the loss of one aircraft. The remainder of June was spent in training new crews; only one ship, a 150-ton schooner, was sunk.

July was a bad month. Although there were successful attacks against shipping the price paid was very high. Six Beaufighters were lost, three of them in one operation on the 23rd. On this occasion S/L. Deck, D.F.C., led an offensive reconnaissance over the central Aegean. At 0850 hrs an Arado was seen ten miles east of Mykonos and the formation went into attack. It was shot down. Beaufighter "A" reported damage and was told to return to base with "N" as escort. Unable to maintain height, "A" was ditched, but both members of the crew—F/O. Bounevialle, D.F.C., and F/Sgt. Potter—were seen to get into their dinghy.

Meanwhile the other four Beaus had found a convoy of some seven vessels. In the attack which followed, a corvette and an auxiliary sailing-ship were both damaged, but Beaufighter "H" was seen to break away with smoke coming from the starboard engine. It was put safely in the water and W/O. Sykes and F/Sgt. Foxley were seen to get into their dinghy. The pilot of

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THE QUEEN'S SQUADRON . . .

"C", F/Sgt. Pennie, reported that he had been seriously wounded; he was instructed to increase speed in order to get home quickly. The leader in "P" acted as escort, and "X", which was experiencing trouble with one petrol cock, was given permission to leave the formation and fly more slowly to increase range. It was never seen again. "N" returned safely independently. A later report said that one of the crews had been picked up by the Royal Navy; and another pilot, F/O. K. Jenkinson, was picked up after spending six-and-a-half days in his dinghy. Apparently he had had his starboard engine hit by flak and later the petrol feed to the port engine failed. In the resulting ditching his navigator was washed away and never seen again. Jenkinson had with him only two packets of chewing gum, a bar of chocolate and a few barley-sugar drops. He bandaged his wounds with pieces torn from his parachute. On the first day a Wellington passed over but failed to see the Very lights which he fired; and on the second day a Beaufighter went by almost exactly overhead and also failed to see the dinghy.

He had no drinking water, so periodically he washed his teeth in salt water and gargled with it to relieve his thirst. The weather became bad and several times he was thrown out of his dinghy into the sea.

For the next four days Jenkinson drifted, sleeping at times but not, curiously enough, feeling badly the effects of hunger or thirst. He had a recurrent dream that he was rescued by a submarine, the commander of which questioned him as to how long he had been adrift. When told "five days," the submariner said: "You are not time-expired yet, you have still a couple of days to go"—and then put him in the sea again.

And it was in the early evening of the seventh day that Jenkinson saw a convoy and fired his last three cartridges. Two, wet, misfired; the third was all right. He then had the mortification of watching the convoy alter course away from him. For a while all seemed hopeless, and he lay down to sleep. But a little later he heard the approach of a vessel. It was a British destroyer; he had been seen, and a boat was being lowered. No longer able to stand the suspense, he dived into the sea to swim towards his rescuers. Safely on board, he was taken to the sick bay; but very soon he was able to face a bottle of beer in the wardroom. In the period he was adrift he lost some 28 lb in weight.

These high casualties, aggravated by the posting away of a number of tour-expired experienced crews, brought the effectiveness of the unit down to a very low level. On top of all this, the commanding officer went sick. In August, training flying hours exceeded for the first time for a long while those spent on operations. Squadron claims for the month in respect of both shipping and aircraft were nil.

But the unit was soon back in form. September was marked by a number of intruder operations over enemy airfields in the Aegean area, and by offensive reconnaissances. The high spot of the month was the effective attack on the *Orion* in the bay of South Denusa. W/C. Revell was posted as non-effective and W/C. C. N. Foxley-Norris took over command.

By October the squadron was quite back on the ball. On the 3rd, the squadron diary records, ten Beaufighters were airborne to find the minelayer *Zeus*. In this they were unsuccessful, but they found a convoy of five other vessels instead. All were damaged, and two set on fire and abandoned. On the 7th the squadron completed twelve months at Gambut—and a very effective twelve months it had been. Later in the month W/C. Foxley-Norris and F/O. Jenkinson flew to Athens to escort Mr. Anthony Eden on a diplomatic mission. Operational hours were up to more than 430 once more.

Toward the end of the month, consequent on the evacuation of Greece by the Germans, shipping targets dropped to nil, but various land targets were attacked in joint actions with Naval aircraft.

In November the bottom fell out of No. 603's war. During the month activities were restricted mostly to reconnaissance of the Dodecanese and Aegean islands. On one or two occasions the Beaufighters were fired at, but no other enemy activity was reported. In fact, the biggest thing of the month was an exercise in which 15 Beaufighters were sent to attack a splash target towed by H.M.S. *King George V*.

The final days of November were spent in packing up, following news of the intended return of the squadron to Britain. On December 26th, 1944, the squadron sailed from Port Said, landing at Liverpool on January 6th. They proceeded to Coltishall. Here the pilots were all posted to the Mosquito Wing at Banff, but the ground crews were retained and put on the strength of No. 229 Squadron, which was thereupon renumbered No. 603. Thus the unit once more became a Spitfire (Mk 16) Squadron, but now engaged in escorting shipping strikes by Beaufighters and in dive-bombing V2 launching sites. At Coltishall five other Spitfire squadrons were performing the same task. The commanding officer of No. 603 was now S/L. Patterson, D.F.C.

(To be concluded)

COMMANDING OFFICERS

S/L. J. A. McKelvie, A.F.C.	1925	W/C. J. R. H. Lewis, D.F.C.	11-43
S/L. H. R. Murray-Philipson	1931	W/C. J. D. T. Revell ...	15-6-44
S/L. Lord G. N. Douglas-Hamilton	1-4-34	W/C. C. N. Foxley-Norris...	23-9-44
S/L. E. H. Stevens	23-8-39	S/L. Patterson, D.F.C. ...	10-1-45
S/L. G. L. Denholm, D.F.C.	29-9-40	S/L. T. C. Rigler, D.F.C., D.F.M.	26-1-45
S/L. F. M. Smith	1-4-41	S/L. H. R. P. Pertwee, D.F.C.	1-4-45
S/L. M. J. Louden	7-7-41	S/L. G. K. Gilroy*, D.S.O., D.F.C.	11-6-46
S/L. Forshaw	19-10-41	S/L. J. W. E. Holmes, D.F.C., A.F.C.	23-9-49
S/L. Lord D. Douglas-Hamilton	19-12-41	S/L. P. J. Anson, D.F.C. ...	1-12-50
S/L. P. Illingworth	10-4-42	S/L. R. Lloyd Davies, D.F.C.	22-3-53
S/L. Marshall	8-42	S/L. R. A. Schofield	25-8-53
W/C. H. A. Chater... ...	28-1-43		

* War-time group captain.

HUBERT SCOTT-PAINE

AS we briefly recorded last week, Mr. Hubert Scott-Paine died recently at his home in Greenwich, Connecticut, at the age of 63.

To the general public he was, perhaps, best known for his achievements in designing and racing high-speed boats, craft which were the prototypes of many used by the Royal Navy and the R.A.F. during the war. In aviation circles he will be chiefly remembered as a pioneer in the manufacture of marine aircraft. He learned to fly in 1910, designed and built several original aircraft—those were landplanes—and presently became manager of the flying-boat business founded by Noel Pemberton-Billing. When the latter entered Parliament in 1916 he handed over control of the firm—by now known as Supermarine—to Scott-Paine, and under his direction a notable series of aeroplanes emerged. Shortly after the war he was joined by Sqn. Cdr. James Bird, and the two began to explore the possibilities of the commercial flying-boat by running experimental services from Southampton to Le Havre and to the Channel Islands with a three-seat, open-cockpit biplane powered by a 160 h.p. Beardmore engine. Thereafter they produced an increasingly successful range of civil and military flying-boats, mainly of biplane configuration with single engines mounted above the fuselage and driving either tractor or pusher airscrews. It was one of these, the Sea Lion II, that won the Schneider Trophy at 145.7 m.p.h. near Naples in 1922.

Mr. Scott-Paine

In 1923 Scott-Paine and Bird formed the British Marine Air Navigation Co., which successfully operated cross-channel services from Southampton to Cherbourg and other places with three Supermarine Sea Eagles, six-passenger flying-boats engined with the Rolls-Royce Eagle. In the following year the company amalgamated with others to form Imperial Airways, of which Scott-Paine became a founder-director.

In 1927 he founded the British Power Boat Co. at Hythe, and thereafter his energies became increasingly occupied with purely marine work, though he remained a director of Imperials until 1940. He leaves a widow and four children.

NEW BRITISH STANDARDS

THE British Standards Institution has recently published, under the authority of its aircraft industry standards committee, twelve new standards for various types of bolts. Three (A.59, A.60, A.111) are for ranges of steel close-tolerance bolts and shear bolts, cadmium-plated for use in aluminium alloys, and the remaining nine (A.113-121) cover UNF-thread bolts in steel, corrosion-resisting steel, and light alloy.

Another recent B.S.I. publication is the *British Standard Code of Practice on the Use of Electronic Valves*. Part 1 gives general information and operating recommendations for all types of electronic valves, whilst Part 2 sets out additional recommendations on the use of domestic receiving valves, cathode-ray tubes and rectifiers. Copies of the *Code* (CP. 1005) are obtainable at 6s from the British Standards Institution, 2 Park Street, London, W.1.

CIVIL AVIATION

MORE VISCOUNTS ORDERED

ORDERS for two more Vickers-Armstrongs Viscounts have been announced, bringing the total number sold to date to 93. The two additional aircraft are for British West Indian Airways, who have increased their order from three to four, and for the Canadian Department of Trade.

U.K.-CANADA DISCUSSIONS

DURING his recent visit to Canada, the Minister of Transport and Civil Aviation, Mr. Lennox-Boyd, spent three days discussing with Canadian Government officials the B.O.A.C./Qantas plan for a round-the-world service by these two Commonwealth airlines. Now that Qantas have taken over the Vancouver - Sydney service formerly operated by B.C.P.A., the global link is almost complete. All that is now required is the provision of one or more suitable calling points in Canada for an overlapping B.O.A.C. service to Australia and the Far East. Although such a service might initially follow the established North Atlantic route *via* Gander and Montreal, the eventual plan for round-the-world services involves a Polar route from London to the west coast of Canada with a single refuelling stop in Alaska.

In a broadcast from Ottawa during his Canadian visit, Mr. Lennox-Boyd pointed out that B.O.A.C. were already entitled to land on the western seaboard of the United States but not of Canada. He said the British airline was not seeking to compete with T.C.A. in carrying passengers across Canada. His statement that the subject would be further examined by the Canadian and British Governments implied that Canada, seeking to protect her own carriers, has not so far conceded the required rights. Neither T.C.A. nor C.P.A. are linked with B.O.A.C. by any form of partnership agreement, as in the case of Qantas and South African Airways.

NEWS FROM JERSEY

ON April 21st Jersey Airlines took delivery of their second de Havilland Heron, G-ANLN. Its predecessor, G-AMYU, which has flown more than 165,000 miles and carried over 10,000 passengers since it was delivered just under a year ago, is now being overhauled. In addition to the Herons, Jersey Airlines operate six Rapides. Excluding B.E.A., they claim to have carried more passengers to and from the Channel Islands last year than all other operators put together, and they expect 1954 to bring a 50 per cent increase in traffic.

The company's staff has recently been strengthened by the appointment as general manager of W/C. L. A. Egglesfield, former director-general of civil aviation in the Caribbean. W/C. Egglesfield began his career with the Royal Navy in 1916; he was an R.A.F. test pilot at Martlesham from 1927 to 1929 and an Imperial Airways captain for ten years from 1930.

PILOTS FOR INDONESIA

ELEVEN former students of Air Service Training, Ltd., at Hamble will shortly be flying as co-pilots with Garuda Indonesian Airways—some, no doubt, on the new Heron feederliners recently bought from Britain. The new pilots, all Indonesians, flew 300 hours on Chipmunks, Austers, Consuls and Dakotas to obtain their Commercial Pilot's Licences at Hamble.

ROYAL CREW (1): On Wednesday H.M. the Queen and the Duke of Edinburgh were due to fly from Aden to Entebbe in B.O.A.C. Argonaut G-ALHW "Aeolus," with members of the Royal Household travelling in another Argonaut, G-ALHD "Ajax." The Royal crew (left) consists of Capt. F. A. Taylor, 1st/off. C. R. W. Taylor, N/Off. A. G. Lacy, R/Off. A. M. Ruthven, 1st Steward A. S. Plumley, 2nd Steward B. H. Monet, Stewardess Monica Tyndall; the "Ajax" crew (right) are Capt. K. Deadman, 1st/ off. G. S. Parkinson, N/Off. K. F. R. Rogers, R/Off. C. S. Gray, 1st Steward T. R. Harris, 2nd Steward E. C. Sturley and Stewardess P. Dallaway; at the head of the steps is Eng. W. G. Ayres.

Evidently the Indonesian airline is not suffering from any immediate shortage of pilots, as it is officially stated that the eleven new recruits are returning to the Far East by sea.

They are accompanied by a twelfth newly qualified pilot, who will be employed on his return as a ground instructor. Thirteen more Indonesian pilots who are undergoing training at Hamble are expected to complete their courses by June. The entire cost of training all 25 students has been borne by the Indonesian Government, which now has its own commercial flying school for *ab initio* pilots.

ONE AIRLINE: 5·8m PASSENGERS

THE 1953 annual report of American Airlines shows that during the year the company swelled its traffic to record proportions and maintained its leadership as the world's largest airline. At the end of the year American's fleet consisted of 177 aircraft—eight DC-7s, 78 DC-6s, 77 Convairs and 14 DC-4s. Since then more DC-7s have been delivered and completion of the order for 25 is expected by midsummer.

The number of passengers carried by the A.A. fleet increased from 5,094,000 in 1952 to 5,807,000 last year—approximately one-ninth of the total number of passengers carried on scheduled services by all the world's airlines. The passenger-miles total increased from 2,906m to 3,290m. Despite increased operating costs, the report notes, American Airlines succeeded in increasing their total profit by 7 per cent—from £4.46m to £4.78m.

A ROYAL DAKOTA

TWO years ago, at short notice, East African Airways were called upon to fly the Queen from Nanyuki, Kenya, to Entebbe, when Her Majesty's sudden accession to the throne made necessary an immediate return to the United Kingdom. The occasion

ON THE STOCKS: Aquila Airways will soon introduce a second Solent on the Southampton-Madeira run. The boat, G-ANAJ "City of Funchal," is seen during the final stage of conversion from Seaford to Solent.

ROYAL CREW (2): Yesterday, April 29th, the Queen and the Duke of Edinburgh were to fly from Entebbe to Jinja (where Her Majesty was to open the Owen Falls Dam) aboard VP-KJU "Sagana II," a DC-3 of East African Airways. The crew chosen for the occasion, and for another flight due to take place today, were: (left to right) Capt. E. E. Morris, chief pilot of E.A.A., Capt. P. A. Travers, R/Off. D. E. Rhodes, Steward G. F. Matthews and F/Eng. W. A. S. Cawthorne.

is recalled by news of the Royal flights due to be made in an E.A.A. DC-3 yesterday and today. The first flight was from Entebbe to Jinja and back; the second, to take place today, from Entebbe to Kasenyi and back.

On both these return flights Her Majesty and the Duke of Edinburgh were to travel in VP-KJU *Sagana II*; the historic journey to Entebbe in 1952 was in *Sagana I*. Both aircraft were named after the lodge presented to the Royal couple as a wedding present from the people of Kenya.

VP-KJU is one of the "newest" Dakotas in airline service. One of the last aircraft of its type to be delivered to the R.A.F. towards the end of the war, it was subsequently stored until its sale to East African Airways last year. Newly overhauled engines from the B.O.A.C. workshops in England were installed before the flight, and the work of overhauling and converting the airframe was undertaken by a total of 62 technicians and workmen.

KHARTOUM'S IMPROVED AIRPORT

AFTER extensive reconstruction work, Khartoum Airport was officially re-opened on Thursday, April 15th, by His Excellency the Governor-General of the Sudan, Sir Robert Howe. In his opening speech Sir Robert mentioned that Khartoum had become one of the great aerial crossroads of Africa, handling, as it does, a thousand aircraft movements a month and 150,000 passengers a year. Its construction was on the most modern lines. the runway, 7,000ft long, could accept a single-wheel loading of up to 45,000 lb; air traffic control and navigational aids were of the most modern type; and the design of the building was probably unique, having a plan form in the shape of an aeroplane.

Sir Robert continued by thanking the various authorities who had contributed to the successful completion of the project. These included the British Ministry of Transport and Civil Aviation, who had subscribed about £400,000 or rather more than half the cost of the airport; the British Air Ministry who, with the Sudan Public Works Department, had been responsible for the runway; International Aeradio, Ltd., of London, who designed, engineered, installed and now operate the air traffic control and telecommunications services; and in particular the Director of Civil Aviation, W/C. G. R. Leather-Barrow.

Sir Robert was received by the Prime Minister of the Sudan, Sayed Ismail El Azhari, and after inspecting a smart detachment of the Sudan Defence Force, he took the salute. He then visited every department of the airport, from kitchens to control tower, where he watched Sudanese controllers, under I.A.L. supervision, give instructions for the start of the air display. This consisted of low level fly-pasts by DC-3s and a Dove of various users of the airport, including East African Airways and Sudan Airways. This was followed by an extremely competent display of aerobatics and close formation flying by four Vampires of 205 Squadron R.A.F. which had specially flown down from the Canal Zone, together with one other single Vampire and a Canberra.

The spectators who had been invited to the opening were a most interesting collection of races and creeds. In the front seats could be seen the senior service officers, British and Sudanese, including the C-in-C. British Troops in the Sudan, General Scoons. Next to him was the grandson of the Mahdi, who in the eighties had been the cause of Earl Kitchener's campaigns in the Sudan. The many European members of the Sudan Government and the British business organizations in the Sudan intermingled freely with the Ministers and Members of the new Sudanese Parliament, some of them in European clothes, but the majority preferring their traditional dress of flowing white robes.

The international standards to which Khartoum Airport has been developed were determined at the second I.C.A.O. Area Navigation Meeting for the African/Indian Ocean Region at Tenerife at the end of 1953. The Comet 1, with a basic take-off requirement of 7,300ft, was selected as the critical aircraft from the viewpoint of runway length, and the Constellation 749A, with a single-wheel loading of 35,700 lb, was decided to be the critical aircraft in respect of runway strength. As indicated by the Governor-General, the newly reconstructed north-south runway exceeds these requirements in both respects. Apart from the new terminal and ancillary buildings, designed by a local architect and built by a Khartoum constructor, most of the aircraft's facilities were provided by British manufacturers. They include Decca Type 40 storm warning radar, as installed at Entebbe and Calcutta; G.E.C. airfield lighting; Read and Campbell fire-fighting equipment; Redifon H/F. radio telephony and Rolls-Royce powered Dennis crash-tenders.

ALITALIA'S LONDON OFFICE

THE opening of Alitalia's new London sales office at 199, Regent Street, W.1., took place on Wednesday, April 14th. Among the guests present were the Mayor of the City of Westminster, the Italian Ambassador, and Alitalia's general manager, Ing. Bruno Velani, who had travelled from Rome for the occasion. The previous day, the company's first non-stop London - Milan service (operated with Convair 340s) had inaugurated Alitalia's summer schedules. The airline's United Kingdom representative is Dr. Notorbartolo, Duke of Villarosa, whose telephone number at the above address is Regent 8333.

NILE JUNCTION: A roof garden overlooking the apron is a feature of the new terminal building (left) at Khartoum Airport which, as reported above, was officially opened on April 15th. On the right: a Sudanese controller is seated at a new I.A.L. desk; glimpsed through the window is a Convair 240 of Ethiopian Airlines, one of the six scheduled operators whose aircraft fly to and from Khartoum.

CIVIL AVIATION . . .

BREVITIES

AS reported in *Flight* last week, Qantas Empire Airways have officially taken delivery of their first Super Constellation, VH-EAG *Southern Constellation*. Names chosen for the other seven L.1049Cs ordered by the Australian airline are: *Southern Sky, Southern Sun, Southern Star, Southern Moon, Southern Wind, Southern Sea* and *Southern Horizon*.

* * *

Mr. James Cuming, supplies manager of Aer Lingus, will shortly take up a new appointment as purchasing manager for British European Airways.

* * *

Wright Cyclone engines installed in the Lockheed Constellations operated by Delta-C. & S. Airlines are now running for 2,000 hours between overhauls. Other news of this airline is that it has recently taken delivery of the first of ten Douglas DC-7s.

* * *

Formerly with Air France, Mr. M. L. Clark has joined Sabena to take up the newly created post of sales manager for the United Kingdom; he will also act as deputy to Mr. A. M. Watrin, Sabena's commercial manager for the U.K. and Ireland.

* * *

Two assessors for the public inquiry into the B.O.A.C. Constellation accident at Kellang on March 13th have been appointed by the Singapore Government: Captain L. Metz, the chief pilot of the Asian and Australasian division of K.L.M., and Mr. C. D. Waldron, airport commandant at Renfrew, Scotland.

* * *

The Yugoslav airline J.A.T. received its first Convair 340 on April 12th. Carrying a number of Convair technicians and instructors, the aircraft was flown by a J.A.T. pilot from San Diego *via* Newfoundland and Shannon. Two more Convairs are due for delivery next month. The new aircraft will be used on the company's Paris - Frankfurt - Istanbul service, to be inaugurated in July.

* * *

To satisfy a demand from drivers and motor cyclists for a souvenir of cross-Channel flights, Silver City Airways have produced an attractively designed badge suitable for mounting on bumper or badge-bar. Chromium plated, with a blue and white centre incorporating the initials G.B. and the Silver City motif, the badge is priced at 19s 6d, including registered postage, and is obtainable from the airline at 11, Great Cumberland Place, London, W.1.

EXPORT AUSTERS: These two J.5G Autocars (155 h.p. Cirrus Major III) are being converted to floatplanes for operation in Scandinavia. One (foreground) will be used for photography and general charter by A. B. Stockholms Aero of Sweden; the other, also for general charter, was bought by A/S Norronafly of Oslo, Norway.

* * *

Under an agreement recently concluded between the S.N.C.A.S.O. organization and the Cornell Aeronautical Laboratory, wind tunnel tests of the S.O. Caravelle twin-jet airliner will begin next August in the Cornell tunnel at Buffalo, New York.

* * *

A report from Brazil says that a company is being formed at Minas Geraes to operate helicopter services between Belo Horizonte and the capitals of Espirito Santo and the State of Rio, and that nine British helicopters (type unspecified) will be acquired for this purpose. It is also announced that the Brazilian Ministry of Agriculture has requested approval to buy ten Hillers equipped as crop-sprayers, at a cost of £15,000 each.

CLUB AND GLIDING NEWS

FOLLOWING the closure of the Reserve Flying School at Redhill, and the decision by the aerodrome proprietors that it was no longer practical to keep the airfield open, the Redhill Flying Club is due to cease operations today, Friday. A farewell flying party was held by members on April 11th, when among the activities was an aerobatic demonstration in Magister G-AJDR by C. Nepean Bishop. Evening discussion in the club bar on that occasion naturally centred on means of keeping the club alive; even if the existing club aircraft are retained, another airfield must be found.

Negotiations are in progress for a temporary home for the club near London, and the present situation is hopeful, but it is a serious blow both to the club and to the club movement in this country that the well-known name of the Redhill Flying Club is to lapse after almost 20 years of existence.

A NUMBER of clubs have decided to fly formations of aircraft across to Jersey for the Channel Islands international air rally on May 15th-17th, each formation being accompanied by an aircraft equipped with radio. The Hampshire Aeroplane Club at Southampton Airport have offered to assist in co-ordinating Customs and air traffic clearances for those flying *via* Southampton; information from groups or from individuals wishing to join a formation, should be sent to the club. Departure times for Jersey are expected to be between 11 a.m. and 12 noon on Saturday, May 15th.

EASTER Monday was the only day of the Easter week-end on which any real degree of soaring was possible from the London Gliding Club's site at Dunstable. With a north-easterly wind, the day's task was distance. From aero-tows by Jack Partridge in his Gemini, Dan Smith reached Christchurch in his Olympia; Godfrey Lee (Olympia) flew to Eastleigh; and Mike Russell and Dr. D. B. James, also in Olympias, landed at Lasham. From a winch launch, Alan Stagg made a creditable 66-mile flight to Hungerford—the first cross-country in his syndicate's newly acquired Olympia—to complete his silver "C", obtaining thermal lift well on into the late evening.

At the club's annual general meeting on Saturday last, April 24th, Mr. D. A. Smith (chairman) stated in his report for 1953 that the number of flying members had increased by 43 to a total of 257. The number of launches had increased by more than a thousand to 7,639, and 1,939 hours had been flown.

The Dent Cup for the most outstanding flight from Dunstable during the year was awarded to Dudley Hiscox, the Desoutter Trophy for the best construction effort to Arthur Doughty, and the Derry Trophy (for the member doing the most work for the club) to Roy Williams. In the informal discussion which followed the A.G.M., the somewhat alarming suggestion of selling advertising space on the club's sailplanes and gliders was made (glider trailers now proclaiming a certain brew to be "so strong—so smooth" are already proving a useful source of revenue).

THE winner of the Long Mynd Cup at the Easter meeting of the Midland Gliding Club was Frederick Breeze (Derby and Lancs), flying a Gull IV, who obtained 217 points. Among the competitors who were not able to stay for the whole period of the contests was Philip Wills, runner-up in his Sky, who earned the maximum of 100 points on each of two days he flew by making a 70-mile declared goal flight to Cardiff, and fastest time (2 hours, 15 minutes) for the 69-mile out-and-return flight to Madley, Hereford. In third position came the Midland Club Olympia, piloted in turn by Hickling, Adams and Martlew.

R.Ae.C. PILOTS' CERTIFICATES—MARCH

No.	Name	Class	Date
28,575	G. Dack	1	2.3.54
28,576	A. M. C. Macklow-Smith	4	5.3.54
28,577	H. Fielding	3	9.3.54
28,578	F. S. Crossley	1	11.3.54
28,579	J. E. Storrar	1	15.3.54
28,580	N. F. Brown	3	16.3.54
28,581	R. A. Robertson	1	23.3.54
28,582	L. T. Chamberlain	2	26.3.54
28,583	P. J. Clarke	3	30.3.54

A page from
THE ESSO HISTOIRE OF AERIAL LOCOMOTION
Adapted from the French de P. Crochet-Damais. Illustrated par Philippe Féty avec permission

SIMON, LE MAGICIEN

IN the year A.D. 66, there lived in Samaria a certain Simon, whom some called "the Mechanician" and others "the Magician." Simon was something of a back-room boy, claimed remarkable and unheard-of powers over the forces of Nature, and allowed it to be bruited abroad that *he could fly*.

The strange rumour reaching Rome, Nero immediately stopped fiddling to summon the Samarian to demonstrate his alleged gift of levitation, and a great crowd assembled in the amphitheatre to witness the extraordinary spectacle. Simon, somewhat nervous, was received with polite applause, and then (according to Arnobus) he took off from the centre of the arena in a cloud of dust. He rose almost vertically and without visible means of support from a launching-site that has never been adequately described . . . and bit the dust in a belly-dive smack in front of the Emperor's box. They carried him away with a broken leg, and the spectators howled for his blood.

Simon did not wait for Nero to sever relations and his main artery. He jumped from the window of the hospital; and (says Suetonius) his second attempt at unaided flight was unhappily no more successful than his first.

Today genius gets results by remembering that it pays to say

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2 *Generators, invertors and transformers or . . .*

3 *Electro mechanical devices, contactors and switchgear or . . .*

4 *Servo mechanisms, magnetic amplifiers, electronics or . . .*

5 *Small high-speed turbines, gearing, clutches, etc.*

There is no age limit. Applicants with Higher National Certificate, or equivalent, will be considered for some vacancies. Applicants may be found suitable if studying for Higher National Certificate. Other vacancies are available for applicants with mature experience of electrical and mechanical engineering practice.

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MAPLE LEAVES IN SPRING: Sabres of Nos. 410, 439 and 421 Sqns., R.C.A.F., lined up at North Luffenham during Air Marshal Slemon's visit. Note the fin flag and fuselage inscription.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

"Flight" photographs

TOP BRASS AND PIPE BAND: Air Marshal Slemon (third from left) with A.V-M. A. L. Campbell (left), the pipe major, and G/C. D. Somerville, station commander (right), and the R.C.A.F. pipe band at North Luffenham (see news item on this page).

Canadian C.A.S. in Europe

AFTER a 16-day visit to the U.S.A., Air Marshal C. Roy Slemon, C.B., C.B.E., C.D., Chief of the R.C.A.F. Air Staff, arrived at London Airport on April 21st for a European tour. His visit began, on April 23rd, with an inspection of the R.C.A.F. bases at North Luffenham and Langar (as illustrated on this page) and he was then due to visit a number of aircraft factories.

Air Marshal Slemon was next to tour R.C.A.F. bases in France and Germany and finally to take part in a five-day N.A.T.O. exercise at S.H.A.P.E. Headquarters, ending today (April 30th).

Before leaving for Europe, Air Marshal Slemon had accepted the 1,000th Canadair-built Sabre on behalf of the R.C.A.F. The aircraft is being signed by all those engaged in its construction and then sprayed with a coat of transparent dope to preserve the signatures.

R.A.F. in Kenya

A CURIOUS air war is being waged against the Mau Mau in Kenya. Amongst the assortment of military and civil aircraft engaged are Lincolns, Vampires, Harvards and Piper Pacers; the last-named, fitted with Harvard-type bomb racks, are being used in an offensive as well as a support role.

The Harvards, though lightly armed, are proving most effective against groups of Mau Mau hiding in the forests. On one occasion, of a group of 20 terrorists driven from cover by bombing, 19 were killed by accurate fire from the single 0.303in machine gun. On another occasion, however, three Harvards flying in formation to a target were caught in a violent downdraught and crashed simultaneously on an open hillside. None of the pilots was seriously hurt and all were rescued by ground troops after a night in the open. Bedding and food were dropped to them from the air soon after the accident.

The most recent air reinforcements are four Vampires, now based at R.A.F. Eastleigh, Nairobi, having been detached from a squadron at Aden. On anti-Mau Mau strikes they carry the standard four 20 mm cannon and four 60 lb rockets each.

Biggin Hill Under Fire

RESERVE and regular units of both the R.A.F. and Army are to take part in one of the largest airfield defence exercises staged since World War 2. Biggin Hill airfield will be attacked between 0900 and 1630 hr on May 2nd by infantry of the Royal West Kent Regiment, T.A., armoured cars of the London Rifle Brigade Rangers, T.A., the R.A.F. Regiment and regular and Auxiliary fighters from North Weald. Defence will be in the hands of No. 2600 (City of London) L.A.A. Squadron, R.Aux.A.F. Regt, a Territorial L.A.A. battery, 500 men of the 7th Metropolitan (West Kent) Home Guard, and a mobile column from the Guards' Training Depot, Caterham. The Biggin Hill Meteor Wing will intercept raiding aircraft.

SWORD-SWALLOWER: The capacious hold of an R.C.A.F. Bristol Freighter disgorges a slightly damaged Sabre fuselage which has been flown to R.C.A.F. Langar for repair.

OLD AND NEW: Reconditioned Grumman Avengers from the new carrier H.M.S. "Eagle" approach with arrester hooks down. In the foreground is H.M.S. "Daring." The picture was secured during the Mediterranean search for the Comet G-ALYY.

Canadian Royal Tour

DURING the coming summer H.R.H. the Duke of Edinburgh is to make an extensive tour of Canada. All point-to-point travel during the tour will be by air. His Royal Highness will fly from London to Ottawa *via* Gander in the R.C.A.F. North Star which recently carried the Canadian Prime Minister on his world flight. The North Star will also be used for several other long flights in the Dominion, and for the flight from Ottawa to Rivers which was originally to be made by R.C.A.F. Comet. The Duke of Edinburgh will visit the Kitimat power project, the Yukon, Port Radium, Coppermine, Yellowknife, Churchill, Quebec, Knob Lake and Goose Bay. The tour will last for three weeks from July 29th.

Honorary Air Marshal, I.A.F.

THE honorary rank of Air Marshal in the I.A.F. has been conferred by the Indian President, Dr. Rajendra Prasad, on Air Marshal G. E. Gibbs, who preceded Air Marshal Mukerjee as Chief of Staff and C-in-C. of the Indian Air Force.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments notified by the Air Ministry:

Group Captains: G/C. H. E. Hopkins, D.F.C., A.F.C., to Weston Zoyland, to command (cancelling the appointment to Middleton St. George); G/C. J. C. Wells, D.F.C., to Department of the Air Member for Supply and Organization, Air Ministry; G/C. H. N. G. Wheeler, D.S.O., O.B.E., D.F.C., to the Department of the Chief of the Air Staff, Air Ministry; G/C. J. W. A. Hunnard to H.Q., F.E.A.F., for administrative staff duties; G/C. F. C. Richardson to the Department of the Air Member for Personnel, Air Ministry; G/C. R. J. Gosnell, D.S.O., D.F.C., to Wildenrath, to command; G/C. H. E. Hopkins, D.F.C., A.F.C., to Middleton St. George, to command; G/C. R. A. R. Rae, O.B.E., to Department of the Chief of the Air Staff, Air Ministry; G/C. S. E. MacKenzie to the U.K. National Military Representative (Paris) for staff duties; G/C. W. I. G. Kerby, O.B.E., to H.Q. 2nd Tactical Air Force, for administrative staff duties.

Wing Commanders: W/C. D. J. A. Rose, D.S.O., D.F.C., to Allied Forces Northern Europe, for staff duties; W/C. C. A. Vernieux, D.F.C., to the Department of the Air Member for Supply and Organization, Air Ministry; W/C. T. Clare to H.Q. No. 40 Group, for Technical staff duties; W/C. M. J. Scott to H.Q. Technical Training Command, for administrative staff duties; W/C. G. Adams to the Department of the Air Member for Supply and Organization, Air Ministry; W/C. A. Prescott to H.Q., F.E.A.F., for administrative staff duties.

No. 502 (Ulster) Squadron Standard

A SQUADRON Standard is to be presented to No. 502 (Ulster) Squadron, R.Aux.A.F., by H.E. the Governor of Northern Ireland, Lord Wakehurst, at R.A.F. Aldergrove on May 24th.

No. 502 Sqn. was formed as a bomber squadron in 1925 with Vickers Vimys. It was transferred in 1938 to No. 18 Group and operated Ansons on general reconnaissance duties at the outbreak of war. After flying Whitleys and Halifaxes, the unit turned to light bombing with Mosquitoes in 1945. Transfer to Fighter Command and conversion to Spitfires came in 1948 and was followed in 1951 by equipment with the Vampire 5s which the squadron now operates. The squadron crest, authorized in 1926, is the red hand of Ulster with the motto *nihil timeo*.

The Army and the Air Force—

IN Malaya, the Austers of No. 656 (A.O.P. Light Liaison) Squadron, R.A.F., are fully engaged in air support and reconnaissance work for the security forces. The pilots of the Austers are Royal Artillery officers and Glider Pilot Regiment sergeants; the various ground duties are shared between R.A.F. and Army personnel. The Squadron's flights are detached to remote jungle landing strips all over Malaya, and their services are constantly called for in dropping all manner of supplies to security patrols in the jungle, and in general communications flying.

On one occasion a Police Field Force patrol was "lost" for two days when its radio failed. An Auster eventually located the patrol only 2,000 yd from another patrol of the Malay Regiment. Messages were dropped to both parties, thus preventing a possible misunderstanding when the two eventually met. The unit is one of the few which have been in Malaya since the beginnings of the emergency in July 1948.

—and the Navy

ONE of No. 848 Squadron's S-55 helicopters in Malaya recently forced-landed in the 3ft-deep mud of a paddy-field. It was impossible under these conditions to salvage it with normal ground equipment, and the helicopter was therefore dismantled and lifted out in sections by other helicopters of the squadron. The sections were suspended underneath the S-55's fuselage and carried to a point where they could be loaded on to road transport and taken back to base for repair.

THE MUDLARK: As described above, an S-55 of the Royal Navy was recently salvaged from a muddy paddy-field. The mud is well shown in the right-hand photograph, sent in by a reader—C.P.O. G. E. Wood, who took part in the operation.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Employment in Canada

I WAS very much interested to read "Disappointed's" letter in your issue of April 2nd. In amplification of his points, the position in the Canadian aviation industry would appear to be as follows:—

(1) *Type of Work.* There is very little chance of doing first-class design work. The avowed policy of the Canadian Government, as voiced by the Hon. Mr. C. D. Howe, is not to do any basic design, but to modify existing aircraft of British or American design. The same opinion is echoed by the heads of the Canadian aircraft industry (see *Canadian Aviation*, February 1954, p. 20). Hence the British engineer should be fully conversant with the type of work he could expect to get in Canada.

(2) *Promotion.* In spite of the fact that the technical training and skill of the British engineer is far superior to that of the American or Canadian engineer (see the article by Prof. W. S. Rouverol, University of California, entitled "A Look at British Technical Training," published in *Mechanical Engineering* in February 1954), he is not given his full due and is treated like a "foreigner" in Canada; he is, therefore, suppressed all the time.

In my opinion, "Disappointed" is crying for the moon if he wants to aspire to the post of a section chief. The chances of obtaining even a group leader's position are remote! The primary reason for this is that American and a few Canadian engineers with barely 10 to 15 years' experience are occupying the posts of departmental heads—some of whom have four or more section chiefs under them. Thus, with these young people at the top holding all the plum positions, how can a British engineer hope to make any headway?

(3) *Salaries.* The present average salary scales in the aircraft industry in the U.S.A. are as follows (see I.A.S. publication *A Guide to Engineering Professions in the Aviation Industries*, January 1954, pages 18 to 26):—

Section Chief ...	$750 to $1600 per month.	Min. experience 8 years
Group Leader ...	$650 to $1000 " " " "	6 to 10 years
Engineer ...	$350 to $700 " " " "	0 to 5 years

The salaries in Canadian industry are 75 per cent to 80 per cent of the above figures—hence the exodus to the U.S.A. after the termination of the contract with the Canadian aviation industry. In this respect, it is interesting to note that the Hon. Mr. Walter Harris has stated that eight out of ten immigrants to Canada either leave for U.S.A. or return to their own home country.

(4) *Living Conditions.* These vary from one part of the country to the other. Thus, in the Province of Quebec, where antiquated Napoleonic laws still prevail, with the religious fervour of the fourteenth century, the life of an English immigrant, and especially that of his wife, would be really miserable. Life in the other provinces may not be so difficult, yet the English immigrant will find himself a total stranger to the manners and customs of his old kith and kin.

In conclusion, my advice would be: (1) To people aged 30 and over: I am afraid you will be disappointed; you will be one of the eight out of ten who do not stay in Canada. (2) To people under 30, and preferably unmarried: you can certainly have a go if you are willing to put up with the various inconveniences or are planning definitely to make Canada a jumping-off ground for the invasion of the South! However, make sure that you get at least $10 for every pound you earn in England.

Montreal. EMPLOYER.

IN fairness to the company which has enabled me to settle happily in Canada, I feel I cannot allow to go unchallenged the statements of "Disappointed" in his letter to would-be Canadian immigrants published in your issue of April 2nd. In particular, I take strong objection to his statements that "vacancies for section chiefs are filled by Americans or Canadians" and that "the necessary experience, qualifications and organizing ability (presumably of such individuals) are in most cases considered superior to those of the British engineer."

May I introduce myself as one who emigrated to Canada almost exactly two years ago and commenced as an engineer "A" in the company which obviously harbours "Disappointed." I am now a section chief in the same company, having held this position for most of a year. In this respect, as a Britisher who has received promotion, I am not unique. At least one other parallel instance occurs in technical engineering, and in design engineering a British engineer holds even higher office. Furthermore, since the introduction of the British element into this particular unit of the Canadian aircraft industry, at least a dozen or more cases can be cited of British engineers being promoted onto the ladder of section chief. In fact, it is difficult to find more than one or two instances of American or Canadian promotions in the same period of time and if any generalization is to be made in regard to promotion it is to the contrary of "Disappointed's" statements.

"Disappointed" says that Britain, unfortunately, is made "scapegoat." The definition of "scapegoat" is one made to bear the blame for other's misdeeds. Who is trying to make a scapegoat of who? Has "Disappointed" also forgotten that he is stigmatizing those who, in large measure, are none other than his predecessors—people who set an example which he should be looking towards, and who landed on this continent in the first place with no facilities whatsoever!

Turning now to the subject of rates of pay, "Disappointed" appears to claim that an ordinary rate of pay would be $9 to the pound sterling. Perhaps if he puts his shoulder to the wheel he may readily achieve this conversion, but he must admit that even five or six dollars to the pound will guarantee him a much higher standard of living than he could obtain in the British Isles. From the tone of his comments, I would assume that the latter conversion is nearest his own mark, yet it seems apparent that he has been able to sample washing machines and Yankee cars, and possibly even television sets and refrigerators, which may be regarded as equally ordinary. Maybe there are better things in life than these, but the better things are to be sought wherever he may go. How much nicer that he should have both!

Finally, on the subject of tie-up between industries, may I suggest that any which may exist are not one iota different from those which similarly exist within the British industry?

Let us, therefore, hope that would-be immigrants to Canada, with the right British spirit, will not allow their resolve to better their lot to be turned aside by the wailings of one who has belatedly found Canada different from his home country and who, perhaps, ought never to have left it.

P.Q., Canada. BRITISH SECTION CHIEF.

Airliners in War-paint

WHAT a wealth of nostalgic emotion must have been generated by John Stroud's survey of the highlights in the life of Imperial Airways, in your issue of April 16th!

What remains to be related is the story of the wartime achievements of many of the worthy machines mentioned. I wonder if a reader can give us first-hand news of the fate of the Short C-Boats impressed into the R.A.F. with turrets in their sterns, their lines utterly spoilt by a mystifying array of A.S.V. aerials; or tell us of the war record of those impressive Hannibals and Heracles, at least one of which, *Hadrian*, was chugging around England in the fall of 1940 disguised as AS982? Is it, in fact, true that as late as 1944 a Short Calcutta was to be seen in use as a trainer for flying-boat pilots? That four of the Armstrong Whitworth Atalantas were impressed into the Royal Air Force in India?

Similarly, virtually nothing has appeared in print about the war service of some of those machines used by the R.A.F. in the 1930s—the Heyfords, Hendons, Virginias, Singapores, Stranraers and Gauntlets.

The war work and fates of these machines are still shrouded in mystery. Perhaps someone can unravel this for me and, I suspect, many others. They all surely deserve an epitaph in *Flight*!

Cambridge. M. J. F. BOWYER.

The B.E.2 Series

AS one who endeavours to write accurately concerning early aircraft and personnel, it is a great pleasure to read Mr. J. M. Bruce's brilliant articles, and an achievement to find anything wrong in them. It was probably not his fault, therefore, that the captions "B.E.2E" and "B.E.12 prototype" for the photographs on pages 479 and 480 respectively (*Flight*, 16th April) were reversed.

Although he mentions the fact, I am surprised that Mr. Bruce does not stress the point more that the B.E.2C and D were inherently stable to a degree which might be described as dictatorial! One could cruise indefinitely with arms folded and feet off the rudder bar, but if one wanted to go in a direction contrary to the machine's inclinations it meant almost a fight! Hence, a very good reason why they were not much good for combat.

For the record, I bought, with a partner, B.E.2E, A.1298, made

CORRESPONDENCE . . .

by Barclay Curle, from Kingsford Smith, Maddocks Aeros, Ltd., for joy riding; it had then become G-EAJA. The venture was not a great success, because passengers wanted to "hold hands" and there was but one passenger seat. I know these particulars are correct—I am writing with the aid of the log-books! I also know that the B.E.2E was a delight to fly and certainly not "a bloody awful machine." But then war service with them was before my time.

Incidentally, the late Sir Nelson K. Johnson, whom I knew very well, had his bad crash at Hounslow in a B.E.2E at night and not in bad visibility as reported. I asked him afterwards what happened and his reply was "I was coming down to land and following my altimeter, and it read 1,000ft when I hit the house." For a coming front-rank meteorologist, this was certainly learning the hard way! I still have a photograph of the result and it is amazing that he got away with injuries to his back only.

Potters Bar, Middlesex. A. H. CURTIS.

[As our correspondent correctly assumes, Mr. Bruce was not responsible for the transposition. Various detail amendments are also due: The allusion to inherent stability on p. 478, para. 5, should have made it clear that the B.E.2C was concerned; on p. 479, the name of 2nd Lt. F. Sowery should have been spelled "Sowrey"; on p. 480, the aircraft with 75 h.p. Rolls-Royce Hawk engines were B.E.2Es; the "Pulpit" (p. 480) had service trials with No. 16 Sqn. in 1915; in the serial numbers list (p. 482, col. 1, final para.), for "225; 241" read "225-241"; and in the same list, it was intended to convey that Nos. 228, 229, 232, 233 and 235 were all used by No. 2 Sqn., and that it was known that 232 (at least) was Bristol-built.—Ed.]

FORTHCOMING EVENTS

April 28-May 1. Institute of Welding: Spring meeting, Porthcawl and Bristol.
May 3-14. British Industries Fair, London and Birmingham.
May 4. R.Ae.S. Section Lecture: "Propellers for High-Speed Aircraft," by G. C. T. Gardiner, A.F.R.Ae.S.
May 6. R.Ae.S.: Annual general meeting.
May 9-16. Saar Aero Club: International gliding contest and rally.
May 15-17. Channel Islands Aero Club: International rally, St. Peter's Airport, Jersey.
May 17-28. Gauge and Tool Exhibition, New Horticultural Hall, London.
May 20. R.Ae.S.: 42nd Wilbur Wright Memorial Lecture: "The Choice of Power Plants for Civil Aeroplanes," by Dr. A. E. Russell, B.Sc., F.I.A.S., F.R.Ae.S.
May 21. Institute of Navigation: "Visual Aids to Bad-weather Approach," by Dr. E. S. Calvert.
May 22. Leicestershire Aero Club: Air display.
May 25. Society of Instrument Technology: Annual general meeting.
May 29. R.A.F.A. Cheltenham and Gloucester: Air Display, Staverton.
May 29. Percival Aircraft, Ltd., and Field Aircraft Services, Ltd.: "At Home" to owners of Percival aircraft, Luton.
May 29. Ragosine/Auster Homing Cup Competition, Rearsby, Leicester.
May 29-30. Leghorn Aero Club: Air tour of Tuscany.
June 2. Pescara Aero Club: International aerobatic contest.
June 5 (or 7). Swansea and District Flying School and Club: Welsh Air Derby.
June 5-6. Niedersachen Section of Aero Club of Germany: International air rally, Hanover.
June 5-7. French Aero Club: Rally.
June 6. Modena Aero Club: International aerobatic contest, Modena.
June 7. S.S.A.F.A.: Air display, Yeadon Aerodrome.
June 11-13. Royal Netherlands Aero Club: International air rally.
June 11-14. Palermo Aero Club: Sixth International air tour of Sicily.
June 13. Tangier Aero Club: Rally.
June 13. R.Ae.S. Garden Party, London Airport.

R.Ae.S. Branch Fixtures (to May 5).—April 30, *Birmingham*, "Aircraft Electrics," by R. H. Woodall and J. H. Rea.
May 5, *Luton*, "The Case for the Light Fighter," by P. Norman.

THE INDUSTRY

English Electric Co-ordination

FROM the English Electric Co., Ltd., comes the announcement that Mr. H. M. Mathews, C.I.E., M.I.E.E., has been appointed director of engineering, in which post he will be responsible for co-ordination and direction of technical policy.

His appointment follows the company's recently adopted practice of further decentralizing day-to-day executive functions, so that the chief engineers at the various works are responsible to the general managers concerned. In order to co-ordinate and organize engineering and development, a directorate of engineering, with headquarters in London, has been set up, and it is this that will be headed by Mr. Mathews.

Following a distinguished career in electrical engineering, mainly in the sphere of power generation, Mr. Mathews joined English Electric in 1948 as adviser to the chairman and managing director, on whose behalf he has since travelled extensively on the company's business, mainly in Australia, Africa, the U.S.A., India and Turkey.

Elected to Hawker Board

AS we briefly noted last week, Mr. J. D. Stranks, A.F.R.Ae.S., chief experimental engineer to Hawker Aircraft, Ltd., has been appointed works director. A Sopwith Aviation apprentice in 1915, he joined the H. G. Hawker Engineering Co. in 1923 and entered the drawing office. He was made experimental-department manager of Hawker Aircraft in 1936, and ten years later became works manager of their Kingston and Langley factories. His appointment as the company's chief experimental engineer followed in 1947.

Mr. J. D. Stranks.

For Pipeline Identification

A NEW type of printed adhesive identification tape for aircraft pipelines has recently been produced by John Gosheron and Co., Ltd., Gayford Road, London, W.12. The tape is laminated, the outer layer being of ethyl cellulose to prevent damage by fuel and lubricants, and is produced in conformity with British and American specifications. Use of the NATO standard identification method means that the repetitively printed wording for a specific application (e.g., fuel, lubrication, hydraulics, de-icing, fire-protection, etc.) is on tape of a selective colour, and also bears, alongside the words, the agreed symbol for each duty.

CHIEF ENGINEERS: As we recorded last week, Short Bros. and Harland, Ltd., are mourning the death of their chief engineer, Mr. A. W. S. Clarke, who joined them 40 years ago. His successor in the post is (right) Mr. H. G. Conway, M.A., F.R.Ae.S., M.I.Mech.E., formerly technical director of British Messier, Ltd.

IN BRIEF

The flight simulator division of Redifon, Ltd., is now situated at Kelvin Way, Crawley, Sussex (Crawley 1540).

* * *

Mr. R. M. Moore, who has been with the ciné-camera firm of W. Vinten, Ltd., since 1946, lately in the post of technical adviser, has taken over the position of sales and publicity manager. He succeeds Mr. T. J. Hawkins, who has joined a publishing company.

* * *

All available exhibition space has now been taken at the new Birmingham Exchange and Engineering Centre, which opens in June as Britain's only permanent engineering centre. Many firms well known in the aircraft ancillary industry are among the 200 which will be represented.

* * *

Mr. N. C. Robertson, C.M.G., M.B.E., deputy managing director of E. K. Cole, Ltd., has been formally elected a director of Ekco Electronics, Ltd. A wholly owned subsidiary, Ekco Electronics were formed last year to handle the marketing, installation and maintenance of electronic and nucleonic equipment.

* * *

It may surprise some people to know that certain aluminium alloys make efficient bearing materials. High Duty Alloys, Ltd., Slough, Bucks, have carried out considerable research in this field, and their newest alloy, Hiduminium 29, is stated to have proved its suitability for main, big-end and camshaft bearings in I.C. engines. Its characteristics are described in a new booklet.

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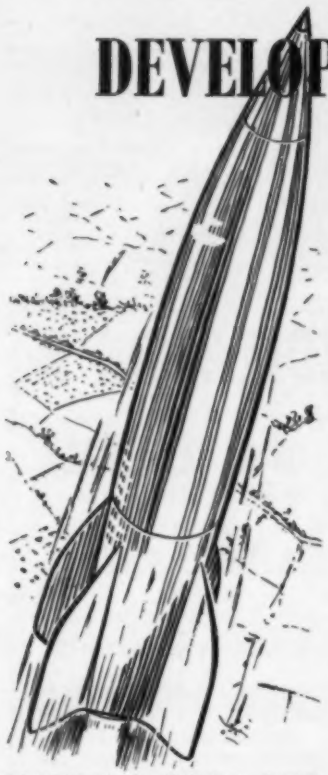

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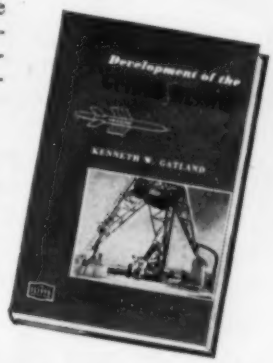

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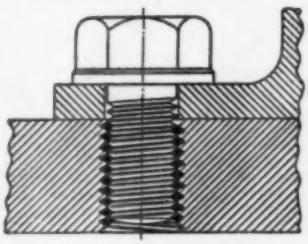

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to take charge of a group engaged on the development of missile control systems and associated simulators.

Applications, with the names of two referees, should be made to:

Employment Manager,
Vickers-Armstrongs Limited,
Weybridge Works,
Weybridge, Surrey.

AIRCRAFT SPRING WASHERS

TO B.S. SPECIFICATION S.P.47

CROSS MFG. CO. (1938) LTD., COMBE DOWN, BATH

TUITION

SOUTHEND-ON-SEA MUNICIPAL AIR CENTRE AND FLYING SCHOOL. Winner of Lennox-Boyd Trophy for Efficiency, 1953.

COMPREHENSIVE flying training for all pilots' licences, ratings and endorsements. Special facilities for instrument, night flying and "twin" conversions. No entrance fee or subscription. M.T.C.A. approved 30-hour course.

MUNICIPAL Airport, Southend-on-Sea, Essex. Rochford 56204. [0453

LEARN to fly for £24; instructors' licences and instrument flying for £3 per hour; night flying £4 per hour; residence 5 gns. weekly. Approved M.C.A. private pilot's licence course.—Wiltshire School of Flying, Ltd., Thruxton Aerodrome, Andover, Hants. [0253

BRITAIN'S AIR UNIVERSITY CAN TRAIN YOU for an airline career. Hundreds of today's airline captains and key maintenance personnel are graduates of this famous establishment. Courses are available for Commercial and Airline Transport Pilots' Licences, Instrument rating and Maintenance Engineers' Licences.

FOR details of these and other courses, apply to—The Commandant, Air Service Training, Ltd., Hamble, Southampton. [0970

A.F.R.Ae.S., A.R.B.Certs., A.M.I.Mech.E., etc., on "no pass no fee" terms; over 95 per cent. successes. For details of exams and courses in all branches of aeronautical work, navigation, mechanical eng., write for 144-page handbook, free.—B.I.E.T. (Dept. 702), 29 Wright's Lane, London, W.8. [0707

AERONAUTICAL. Comprehensive full-time technical and practical training for careers in all branches of aviation engineering. Diploma course leads to interesting executive appointments in civil aviation design and development, draughtsmanship, maintenance, etc. Extended courses to prepare for A.F.R.Ae.S. and A.M.I.Mech.E. examinations.—Write for prospectus to Senior Master, College of Aeronautical Engineering, Chelsea, London, S.W.3. Flaxman 0021. [0019

PACKING AND SHIPPING

R. AND J. PARK, Ltd., 143-9 Fenchurch St., E.C. Tel.: Mansion House 3083. Official packers and shippers to the aircraft industry. [0012

EXPORT PACKING SERVICE, Ltd., Imperial Buildings, 56 Kingsway, W.C.2. Phone: Chancery 5121-2-3. Scientific packers to the Services and industry. Specialists in the packing of aircraft and aircraft components. Approved packers for the Admiralty, A.I.D., I.F.V., C.I.A., C.I.S., I.E.M.S., M.o.S. and many foreign Government Departments. [0920

PHOTOGRAPHY

FAIRCHILD cameras K24, K20, K19, K8A-B, brand new.—E.W.S. Co., 69 Church Road, Moseley, Birmingham. [1752

PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

APPLICATION No. 292 from Flightways, Ltd., of Southampton Airport, Eastleigh, for an inclusive tour service with Dakota aircraft and later possibly with Hythe and Solent flying boats for the carriage of passengers and supplementary freight between Southampton and Tangier at a frequency of one return flight weekly, during the period from October 1st, 1954, to September 30th, 1960.

APPLICATION No. 294 from British Overseas Airways Corporation, of Airways House, Great West Road, Brentford, Middlesex, for amendments to the normal scheduled services which they operate on the routes set out as Routes Nos. 3 and 5 in Schedule "A," Part I, to the terms of reference issued to the Council by the Minister of Civil Aviation on July 30th, 1952, so as to permit them at their discretion to extend the former service from Hong Kong to Singapore and the latter from Singapore to Hong Kong or to Hong Kong and Tokyo.

APPLICATION No. 295 from Flightways, Ltd., of Southampton Airport, Eastleigh, for an internal service with D.H.89 and later possibly with Dakota and/or Bristol 170 aircraft, for the carriage of passengers, supplementary freight and mail between Portsmouth and Ryde or Bembridge at a frequency of up to 12 return flights daily, during the season April to October inclusive for a period of seven years from the date of approval.

THESE applications will be considered by the Council under the terms of reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing, stating the reasons, and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9 Buckingham Gate, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [1967

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

HANDLEY PAGE, LTD.

seek to appoint technical staff in the following categories:

AERODYNAMICISTS

DESIGNER STRESSMEN

DESIGNER DRAUGHTSMEN

TEST HOUSE ENGINEERS

of degree or Higher National Certificate standard

and

WEIGHTS CONTROL ENGINEERS

LOFTSMEN

of ordinary National Certificate standard

required for interesting programme of work on super-priority projects.

THE positions available are permanent and pensionable and carry generous salaries with ample opportunity for advancement to progressive men.

WORKING conditions are good, and in some cases the company are able to give assistance in housing problems.

INTERVIEWS may be arranged for Saturday mornings at Cricklewood or at a place near to the applicant's home if practicable.

APPLICATIONS, stating age, qualifications and full details of experience, should be sent to:

Staff Officer,

HANDLEY PAGE, LTD.

Cricklewood,
London, N.W.2. [1938

AERODYNAMICISTS

A RAPIDLY expanding precision instrument manufacturing firm holding long-term design and development contracts has the following vacancies:

(a) Senior aerodynamicist with experience of dynamic stability analysis in connection with the design and development work of autopilots. Knowledge of servo mechanisms an advantage. Position offers exceptional opportunity for the right man. Ref. S.E./2.

(b) Young graduates and personnel with equivalent professional qualifications for training in the above field. Ref. G.E./2.

PLEASE forward full details of career and salary required (which will be treated in strict confidence), quoting appropriate reference, to Box 4582. [1956

Expanding

Gas Turbine Activities

of

D. NAPIER & SON, LTD.

demand the appointment of

ENGINEERS

both junior and senior, for design, development, research, production and testing.

APPLICATIONS from men with experience in any of the following will be particularly welcome:—

Weight Control
Stress Calculation
Forward Project Design
Blade Design
Control Systems
Full-scale Engine Design
Engine Test Administration
Performance Analysis and Report Writing
Vibration Investigation
Failure Investigation
Engine Build Specification Research
Jig and Tool Design
(only senior positions)
Planning
New Process Development
(particularly sheet metal fabrication)
Test Plant Design

Applications should be addressed to:—
CENTRAL PERSONNEL SERVICES
336-7 Strand, W.C.2.
Quoting reference S.A.30F. [1866

PILOT required for internal service. Dove endorsement essential. Apply B.K.S. Air Transport, 13a Old Burlington Street, W.1. Tel.: GROsvenor 7478. [1943

SCOTTISH AVIATION LTD.

PRESTWICK AIRPORT

URGENTLY REQUIRE

STRESSMEN

AND

PLANNING ENGINEERS

WITH AIRCRAFT EXPERIENCE

FOR WORK ON A

NEW PROJECT

Good salary and prospects

A number of
HOUSES
will be available to suitable applicants

ALSO STAFF PENSION SCHEME

APPLY TO: PERSONNEL MANAGER

SCOTTISH AVIATION LTD.
PRESTWICK AIRPORT

AIRCRAFT EQUIPMENT

The Aircraft Equipment Division of

THE ENGLISH ELECTRIC COMPANY

is expanding its activities to exploit recent substantial advances which it has made in this field. Applications are invited from enthusiastic engineers in the following categories:

Mechanical and Electrical Draughtsmen.

Installation and Layout Draughtsmen
(Ex-Servicemen with suitable experience will be considered for training).

A.C. (400 cycles) and D.C. **Machine Designers.**

A.C. and D.C. **Control Gear Designers.**

Magnetic Amplifier Designers.

System Engineers (400 cycles).

General Mechanical and Hydraulic Engineers.

Development and Experimental Engineers.

Sales and Contracts Engineers
(Aircraft experience is not essential, but R.A.F. or Civil Airline experience would be useful background).

Applications, quoting reference S.A.47, should be addressed to

DEPT. C.P.S., 336/7 STRAND, W.C.2.

SITUATIONS VACANT

THE SUPERMARINE WORKS OF VICKERS-ARMSTRONGS, LIMITED

NOW IN PRODUCTION OF SUPER-PRIORITY AIRCRAFT, REQUIRE:

TECHNICAL ASSISTANTS

for structural analysis and structural testing. Qualification, degree or H.N.C. Previous experience of this work not essential.

AERODYNAMICISTS

Qualification: degree or equivalent standard. Some experience in aeronautical engineering desirable.

DESIGN DRAUGHTSMEN
(Senior and Junior)

Preferably with aircraft experience, but men with mechanical, structural or electrical experience also considered. Requirements are mainly for airframe design, but certain vacancies exist for work on wind tunnel models and equipment, and on aircraft instrumentation.

FULL-SCALE LAYOUT DRAUGHTSMEN
(Senior and Junior)

Preferably with aircraft experience.

JIG AND TOOL DRAUGHTSMEN

For designing machine fixtures, assembly tools and jigs.

Write, giving full particulars, including age and salary required, to Personnel Department, Hursley Park, near Winchester, Hants. [1935

SAUNDERS-ROE, LTD.

have

vacancies

for

STRESS ENGINEERS

AERODYNAMICISTS

and

DRAUGHTSMEN

for

Aircraft Design

Electrical Design

and

Full-scale Layout

THE company would be pleased to hear from experienced engineers interested in employment in the Isle of Wight.

THERE are pension and assurance schemes and practical assistance with housing will be given to successful applicants.

APPLY, stating age, experience, salary, etc., and quoting ref. F/3, to the Personnel Officer, Saunders-Roe, Ltd., East Cowes, I.O.W. [1844

GOLD COAST LOCAL CIVIL SERVICE

Vacancy for Meteorologist (Agricultural)

APPOINTMENT: On contract for two tours (18 to 24 months each tour) with consolidated salary in the scale £1,530 to £1,950 p.a. plus gratuity of £37 10s. for each completed three months resident service, payable on satisfactory completion of contract. Outfit allowance £30 to £60. Free return passages; leave of seven days for each completed month's resident service; furnished quarters, when available, at £75 to £90 p.a.; income tax at low local rates.

QUALIFICATIONS: Second class honours degree in physics or mathematics or the equivalent, with seven years experience as a professional meteorologist. Previous experience in tropical or sub-tropical countries an advantage.

DUTIES: To specialize in agricultural meteorology.

APPLY, in writing, to the Director of Recruitment, Colonial Office, Great Smith Street, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number BCD.57/13/02. [1954

SILVER CITY AIRWAYS, LTD.

OPPORTUNITIES exist at Blackbushe and Lympne Airports for senior staff (technical) with current engine and airframe licences on Freighter, Dakota, Hermes aircraft.

WRITE for application forms and appointment to Engineering Superintendent, Blackbushe Airport, Camberley, Surrey. [1951

VACANCY for a press officer in a central office in London, connected with aviation. Salary by arrangement. Apply Box 4878. 1932

VICKERS-ARMSTRONGS LIMITED
WEYBRIDGE WORKS

GUIDED WEAPON DEVELOPMENT

Applications are invited from experienced ENGINEERS *for senior staff appointments in the following grades:—*

ELECTRONIC ENGINEER
—to lead Group on Servo Control and Simulator Design.

ELECTRO - MECHANICAL DESIGNER — to develop small mechanisms.

Vacancies also exist for:—

ENGINEERS

TECHNICAL ASSISTANTS

DRAUGHTSMEN
(Senior, Intermediate, Junior and Trainee)

LABORATORY ASSISTANTS and MECHANICS
For work on structural, electronic, electrical and mechanical engineering development.

Suitable academic qualifications are required:
Engineers and Technical Assistants—graduate or equivalent.
Draughtsmen and Laboratory Assistants — H.N.C. standard.

Applications should be sent to:

EMPLOYMENT MANAGER,
VICKERS-ARMSTRONGS LIMITED
Weybridge Works, Weybridge, Surrey

SITUATIONS VACANT

EAGLE AIRWAYS OF BRITAIN

HAVE immediate vacancies fo the following categories of aircrew:—

CAPTAINS AND FIRST OFFICERS

Endorsed Viking and Dakota Aircraft

RADIO OFFICERS

ALSO required a captain endorsed for York aircraft for Cyprus commitment.
APPLY immediately to Chief Pilot, Eagle Aviation, Ltd., Blackbushe Airport, Camberley, Surrey. Tel.: Yateley 2371. [1968

REQUIRED FOR SERVICE IN MIDDLE EAST

1. Aircraft maintenance foreman, minimum qualifications A and C licence with Dakota and P and W R1830 endorsement. Salary £1,200-£1,250-£1,312-£1,375-£1,438 plus cost of living allowance, initially at £168 p.a. Post service benefit scheme. Eighty days paid leave in U.K. p.a. with free return air passages for employees and families.
2. Aircraft maintenance fitters with recent experience of Dakota aircraft. Salary £863-£900-£938-£975-£1,012 plus cost of living allowance, initially at £148 p.a. Other conditions as given above.

APPLICATIONS to Airwork Ltd., Overseas Division, Sutton Lane, Langley, Bucks. [1945

AIRWORK GENERAL TRADING CO., LTD., require a licensed engineer with A and C licences on Dakota aircraft, for service in Aden.
APPLICATIONS should be made in writing, giving details of past experience, etc., to the Service Manager, Airwork General Trading Co., Ltd., Blackbushe Airport, nr. Camberley, Surrey. [1919

ASSISTANT chief inspector required for aircraft factory in West Scotland. Must have five years recent experience similar capacity.
ATTRACTIVE salary, staff pension scheme, excellent welfare and canteen facilities.
APPLICATIONS, stating experience and age, should be addressed to Box 4955. [1960

WANTED, pilot with senior commercial, I. rating and Rapide endorsement for June, July, August. Salary £100 per month.—Apply: Manx Airlines, Ronaldsway Airport, Isle of Man. [1959

TECHNICAL assistant required by firm being established in north-east England to make important specialized product for aircraft, now successfully developed with good prospects.
EXPERIENCE as aircraft or component draughtsman is essential, together with an aptitude for technical administration, but no specialized design knowledge is required.
THIS is an invitation to a young man to join new organization at an early stage exercising initiative in wide sphere. House may be available. Write, giving all particulars, to Box 4879. [1936

SERVICE engineers required for installation and trials of aeronautical and marine navigational equipment. Applicants must be of good appearance, prepared to travel in U.K. and have the following qualifications:
(a) Aeronautical: Under 35 years of age with electrical and radio theory to C. and G. Radio III standard.
(b) Marine: A.C. and D.C. electrical theory to approximately O.N.C. standard. Knowledge of electronics or radar preferable.

GOOD conditions; expense and travelling allowances; pension scheme.—Apply, with full details including salary, quoting No. 1477, to Personnel Manager, Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middlesex. [1953

ON the ground floor. Well-known designer starting interesting new project design London, requires several senior, semi-senior detailing and junior D.O. staff. Reply fully, experience, salary required.—Box 4994. [1965

APPENDIX A clerk required for technical office of Design Dept. Good position for man able to compile complete Appendix A. Write Personnel Supervisor, Hawker Aircraft Ltd., Canbury Park Road, Kingston-on-Thames, Surrey. [1939

JIG and tool draughtsman (senior) required. Good welfare facilities including staff pension scheme.—Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [0593

SENIOR and intermediate design draughtsmen, with good experience of aircraft or light structural or mechanical engineering, required for aircraft and armament project work.—Apply, by letter, to Portsmouth Aviation, Ltd., The Airport, Portsmouth. [0612

SENIOR, intermediate and junior draughtsmen required for aircraft work of super priority. A.E.S.D. rates and upwards, depending on ability. Aircraft experience desirable but not essential. Apply, giving age and details of experience and salary required to Personnel Manager, Helliwells, Ltd., The Airport, Walsall. [1966

SENIOR stressman for important and interesting work in the civil and military spheres of aeronautical engineering, embracing turbines for aircraft air conditioning, accessory installations, turboprops, small high-speed turbines and blowers. Applicants should be of degree standard with at least three years' experience in engine or allied fields. (Ref. 70).—Write in detail, quoting reference No. of position sought, to The Personnel Dept. (Technical Employment), de Havilland Propellers, Ltd., Hatfield, Herts. [1922

Blackburn and General Aircraft Limited

LONDON DESIGN OFFICE—63, Old Brompton Road, S.W.7.

Vacancies exist for the following staff to join an expanding design team

SECTION LEADER STRESSMEN
5 years aircraft experience essential

SENIOR DESIGN DRAUGHTSMEN
Aircraft experience necessary

Interesting work and excellent prospects for the right type of man.
Every opportunity for advancement. Congenial working conditions.
Pension and Life Assurance Scheme.
Please write to Manager at the above address.

THE
DE HAVILLAND
ENGINE COMPANY LIMITED

has vacancies at

STAG LANE

for

SENIOR DESIGNERS
DRAUGHTSMEN AND
STRESSMEN

for work on the

DESIGN AND DEVELOPMENT OF GAS TURBINE ENGINES and other interesting projects

The appointments are permanent, command GOOD SALARIES and offer excellent opportunities to first class men

SUPERANNUATION SCHEME

Arrangements made for interview to take place locally and on Saturday mornings if necessary

•

Please write in confidence, giving full details of qualifications and experience to

THE PERSONNEL OFFICER
THE
DE HAVILLAND
ENGINE COMPANY LIMITED
STAG LANE, EDGWARE
MIDDLESEX

SITUATIONS VACANT

ARMSTRONG SIDDELEY MOTORS require fully experienced aircraft instrument mechanic. Must be capable of Calibration of Experimental Aircraft Instruments including electrical installations (*not* radio).—Apply by letter stating experience, and qualifications, to Reference AIM, Personnel Manager, Armstrong Siddeley Motors, Coventry. [1901

TECHNICAL illustrators (male, senior) required. Considerable practical experience of illustrating for sales brochures and descriptive manuals essential. Good welfare facilities including staff pension scheme.—Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [0592

H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft.—Hobson Works, Fordhouses, Wolverhampton. [0420

THE Supermarine Works of Vickers-Armstrongs Ltd., invite applications for technical posts dealing with the development flight testing of fighter aircraft. Degree or equivalent qualification and some experience of similar or allied work essential. Write giving full particulars to: Personnel Department, Vickers-Armstrongs Ltd., Hursley Park, Nr. Winchester. [1940

ARMSTRONG SIDDELEY MOTORS require a young engineer interested in the development of instrumentation for the flight testing of gas turbine aero engines. Some knowledge of electronics is desirable. Preferably applicants should possess a degree, though this is not essential. Reply to Reference TGD2, Personnel Manager, Armstrong Siddeley Motors, Coventry. [1934

PATENTS Department of the Bristol Aeroplane Co., Ltd., requires additional technical assistant experienced in the preparation and prosecution of patent applications; preferably passed intermediate examination of Institute of Chartered Patent Agents and between 25/35 years of age. Applications with full details to:—Chief Personnel Officer, Filton House, Bristol. [1946

HANDLEY PAGE (Reading), Ltd., The Aerodrome, Woodley, Reading, have vacancies in their design office for senior and intermediate draughtsmen and weightsmen. The work is on an interesting new project and there will be scope for rapid advancement to suitable applicants.—Please send full particulars of experience, etc., to the Personnel Officer. [0235

ELECTRONIC engineer for research laboratory. Senior position for engineer with experience of research and design of special circuits at medium to low frequencies. Knowledge of physics an advantage. Qualifications should include a good degree and preferably five years' experience in similar post. Interesting and rewarding work with excellent prospects for advancement. (Ref. 73).

SENIOR engineer for work in modern research laboratory on problems of high-speed switching, gas tube circuits and general pulse methods. Problems call for advanced techniques, good degree or equivalent in electronic engineering with not less than three years' experience required. (Ref. 74).

SENIOR servo-mechanism engineer for research work on complicated instrument type servo. Work involves analysis of present systems and design of new types. Experience of general electronics, gyro mechanisms and analogue computors an advantage. This post calls for a man with excellent qualifications and at least three years' experience on similar problems. (Ref. 75).

WRITE, in detail, quoting reference No. of position sought, to The Personnel Dept. (Technical Employment), de Havilland Propellers, Ltd., Hatfield, Herts. [1923

AIR FORCE, Naval, civil and helicopter aircraft all under design and development at Percival Aircraft, Ltd., Luton Airport, Bed. Applications are invited from senior and junior draughtsmen and stressmen for work on this interesting programme. Good welfare facilities, including staff pension scheme.—Write, giving details of experience and salary required, to Personnel Manager. [0595

DEPUTY chief engineer. Applications for this post are invited in confidence. Operating Dakota, Dove, Rapide on scheduled services Liverpool-Cardiff-Bristol Channel Islands-Paris. Necessary licences essential and salary according to experience and qualifications.—Apply Chief Engineer, Cambrian Air Services, Ltd., Rhoose (Cardiff) Airport, nr. Barry, Glam. Tel.: St. Athan 86. [1955

DRAUGHTSMAN required for work on aircraft components. Experience in the aircraft industry desirable but not essential; good mechanical engineering draughtsman will be considered. Capable of working with the minimum of supervision. Write, giving particulars of age, experience and technical qualifications, to: King Aircraft Corporation, Fifth Street, Montrose Avenue, Hillington, Glasgow, S.W.2. [1933

ARMSTRONG SIDDELEY MOTORS, Coventry, have vacancies for a number of designers and senior and junior draughtsmen. Although gas turbine experience is most advantageous it is not necessarily essential as training will be given in this specialized work to suitably qualified draughtsmen.—Apply, in detail, to Reference F.103, Personnel Manager, Armstrong Siddeley Motors, Coventry. [0200

AIRFRAME stressmen are required for a design office in the south of England and salaries of £800, to £1,000 per annum are offered to applicants with six to 10 years' experience, and to those with three to five years' experience, £13 to £15 per week.—Please send particulars of experience, qualifications and age, stating whether married, to Box AC88922, Samson Clarks, 57-61 Mortimer Street, W.1. [0236

VICKERS-ARMSTRONGS
LIMITED

WEYBRIDGE, SURREY

require :

(a) **TECHNICAL WRITERS** in Drawing Office, to produce bulletins of aircraft modifications. Applicants should have sound engineering and aircraft experience, and be able to read an engineering drawing. Applications from suitable ex-R.A.F. personnel welcomed.

(b) **FLIGHT TEST OBSERVERS.** Applicants must have had aircraft experience and possess at least H.N.C. in mechanical engineering or equivalent academic qualifications. They must also be physically fit for long and frequent periods of high altitude flying in jet aircraft.

(c) **FLIGHT TEST ASSISTANT.** Applicants must have had aircraft experience, and possess H.N.C. in mechanical engineering or equivalent academic qualification; mainly for ground work.

(d) **INSPECTORS/VIEWERS** to cover work on electrical systems, aircraft finals and in Machine Shop Tool Room, Tinsmiths and Sub-assemblies Shops; also to inspect many other branches of production and development work.

(e) **LABORATORY ASSISTANTS** for calibration and maintenance of flight test instrumentation. Applicants should hold O.N.C. in electrical engineering or some similar qualification and have had experience with telecommunications and electronic equipment. Applications from suitable ex-R.A.F. personnel of the Radar Branch, etc., welcomed.

Applications to:
Employment Manager,
VICKERS-ARMSTRONGS, LTD.
WEYBRIDGE WORKS,
WEYBRIDGE, SURREY.

Weybridge Station is 30 minutes from London on the main Waterloo/Portsmouth line.

Additional buses operate to and from the Works at starting and finishing times.

Canteen facilities.

Applicants should be in a position to arrange their own housing accommodation. Assistance can only be given with individual lodgings.

SITUATIONS VACANT

SENIOR and Junior Stressmen vacancies for interesting programme of project and development work. Previous experience not essential for junior posts. H.N.C. minimum qualification. Salary in accordance with experience and qualifications. Limited housing accommodation available for selected applicants. Full particulars in writing to Personnel Manager, Flight Refuelling Ltd., Tarrant Rushton Airfield, nr. Blandford, Dorset. [1931

STRESSMEN required in Reading area for aeroplane structures. One senior with at least eight years stressing experience and minimum qualifications of A.F.R.Ae.S. or H.N.C. Workshop and D.O. experience desirable but not essential. Commencing salary approx. £950 p.a. Two assistants with H.N.C. minimum qualifications and at least four years stressing on aircraft. Commencing salaries approx. £780 p.a. Write brief details to Box 4915. [1948

ARMSTRONG SIDDELEY MOTORS require 20 draughtsmen with Ordinary National Certificate or higher qualifications and sound engineering training for work in a rapidly expanding department in connection with rocket motors for aircraft propulsion. Applicants should preferably be between ages of 22 and 30. Permanent positions, staff pensions scheme available. Apply to Reference D1, Personnel Manager, Armstrong Siddeley Motors, Coventry. [1918

HONOURS graduate in mechanical engineering required for industrial gas turbine department, with a view to appointment as design engineer after a period in experimental department. Work has two main aspects, performance and mechanical design. Applicants must have special inclination towards one or both.—Applications, stating age, qualifications and experience to Employment Manager, Ruston and Hornsby, Limited, Lincoln. [1969

GUIDED WEAPONS

SENIOR ELECTRO-MECHANICAL DESIGNER

is required for work connected with Guided Weapon development. Applicants should have suitable experience, with H.N.C. or higher qualifications, and be capable of controlling a design group.

Applications, with names of two referees, should be made to: Employment Manager, **Vickers-Armstrongs Limited, Weybridge Works, Weybridge, Surrey.**

SITUATIONS VACANT

VACANCIES exist at Percival Aircraft, Ltd., for a number of senior stressmen on both military and civil aircraft and helicopter. Applicants must be capable of taking full responsibility for either a complete aircraft or a major component. Good salary with prospects to successful applicants and the positions carry monthly staff status.—Write, stating age, full details of experience, qualifications and previous appointments held, to the Personnel Manager, Percival Aircraft, Ltd., The Airport, Luton, Beds. [1900

THE BRISTOL AEROPLANE Co., Ltd., has vacancies in Bristol for senior technical illustrators. Applicants must be able to prepare fine line illustrations in black and white from workshop drawings and be able to prepare exploded and cut-away perspective engine views for technical publications. Salaries, pension scheme, working conditions and prospects of promotion on merit are excellent. Applications giving details of experience, age and qualifications should be addressed to:—The Personnel Manager, Engine Division, The Bristol Aeroplane Co., Ltd., Filton House, Bristol. [1947

PRODUCTION AND SALES RIGHTS FOR U.S.A.

Exclusive Distributorship

Devices and accessories of mechanical and of hydraulic nature wanted by manufacturer well established in Aircraft Industry, equipped for production, engineering, servicing, etc.

Write Box 4871 c/o Flight

FOR EXPORT

TIGER MOTHS, MK. 2

Completely reconditioned and superbly finished aeroplanes. Full night flying and navigation lights. Electrical intercom.

Keenest C.I.F. Quotations per return.

MUIR & ADIE LIMITED

CROYDON AIRPORT, SURREY, ENG.

Cables: MUIRAIR, CROYDON

SITUATIONS WANTED

PILOT, C.P.L., R/T, I/R, 1300 hrs, full time or week-end, southern England.—Box 4969. [1958

COMMERCIAL pilot, 31, 1,800 hours singles. Experienced on Auster, Chipmunk, Norseman, Beaver, Vampire aircraft. Requires position U.K. or overseas, available December. Would be willing to convert to twin-engined aircraft.—Box 4920. [1950

AVIATION executive, 42, seeks change where a lifetime experience in the flying, technical, and administrative fields can contribute to aeronautical progress, particularly to safety in flight. Engineering education (University), wide flying experience including multi-engined and turbo-jet aircraft. Current A.L.T.P. licence, graduate E.T.P.S. War experience in command of large operational units, also air staff appointments. In addition to test flying, civil employment has included all aspects of aerodrome operation, control of aircraft maintenance workshops, also organizing a large design and development team for specialized aircraft equipment. Fully conversant with M.O.S. and A.R.B. requirements. Principals apply Box 4815. [1925

BOOKS, ETC.

FOR sale, "Flights" complete from Sept. 28th, 1939, up to present day.—Offers to K. Dixon, 39 Water Lane, London, S.W.2. BRI. 9786. [1949

"YACHTING Quizzes," by Max A. Chappell. Packed with information on everything nautical, from tides to trade winds, from fishing grounds to first aid. A book every enthusiast must read. 3s. 6d. net from all booksellers. By post 3s. 9d. from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

Only a limited quantity

U.S.A. OFFICERS' STYLE 3-COMPARTMENT

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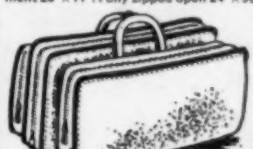

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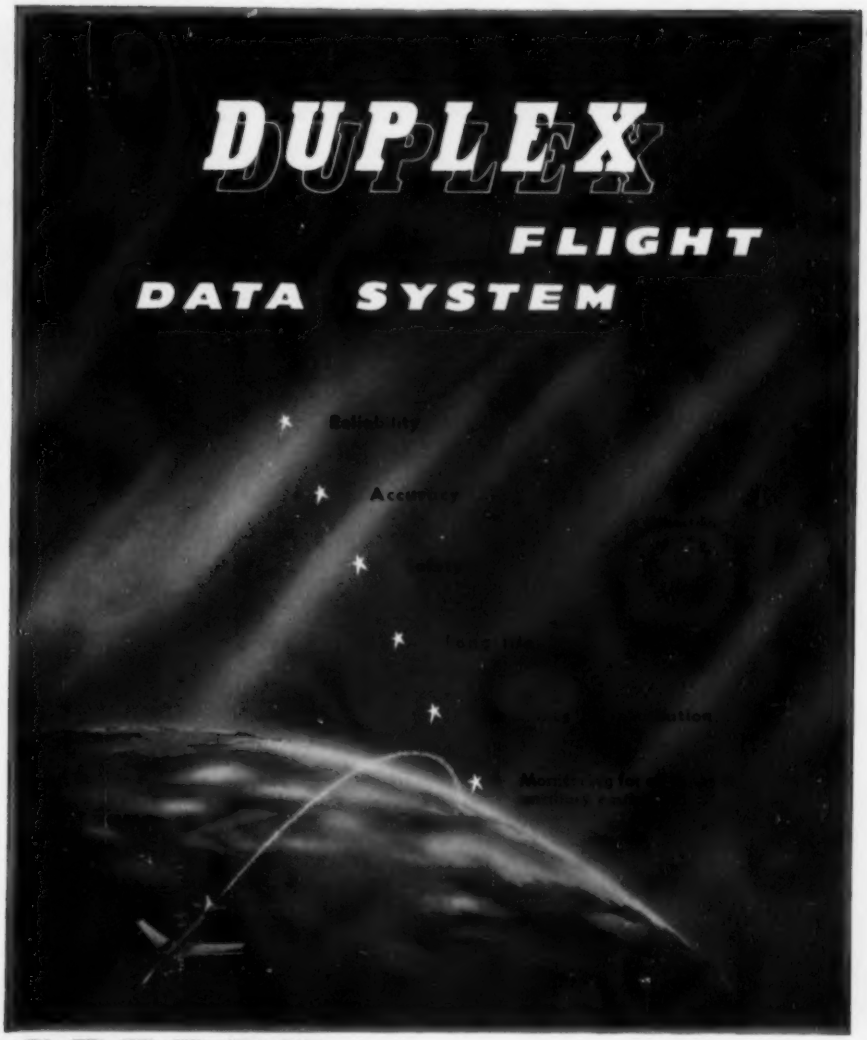

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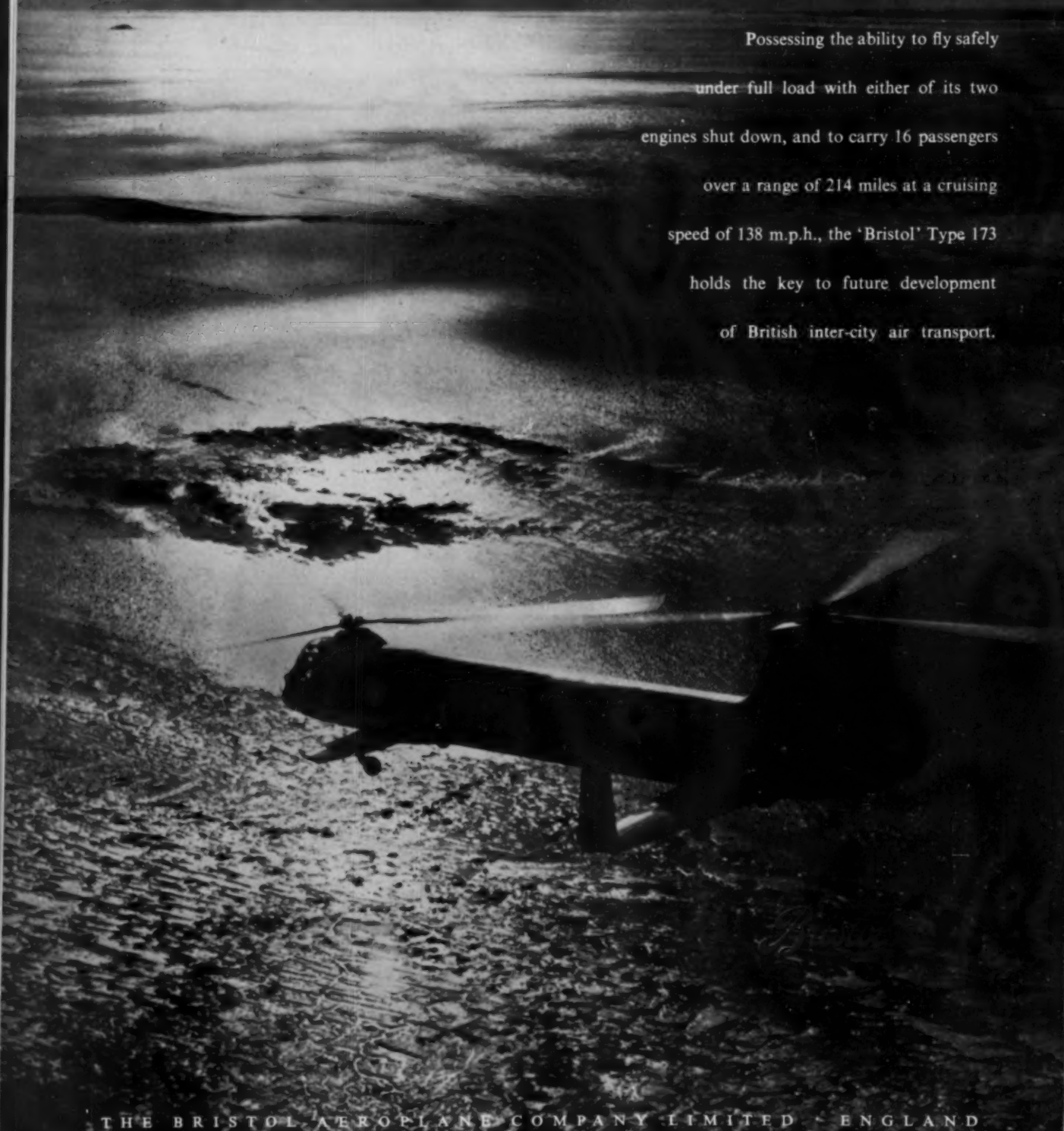

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